

# CONTROL OF SMALLPOX AND CHOLERA IN INDIA

REPORT ON THE  
DELIBERATIONS OF THE CENTRAL EXPERT COMMITTEE OF THE INDIAN  
COUNCIL OF MEDICAL RESEARCH ON SMALLPOX AND CHOLERA  
HELD JOINTLY WITH THE REPRESENTATIVES OF THE STATES  
EXPERT COMMITTEES ON SMALLPOX AND CHOLERA IN NEW DELHI ON  
16TH 17TH, 18TH AND 19TH FEBRUARY 1959



सत्यमेव जयते

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## MEMBERS OF THE JOINT COMMITTEE

### Members of the Central Expert Committee .

1. Dr. C.G. PANDIT,  
Director,  
Indian Council of Medical Research,  
New Delhi. (Chairman)
2. Dr. M.S. CHADHA,  
Deputy Director-General of Health Services,  
New Delhi.
3. Lt.-Col. BARKAT NARAIN,  
Adviser Health,  
Ministry of Community Development & Co-operation,  
New Delhi.
4. Dr. B.S. YAJNIK,  
Shaha Najaf Road, Hazrat Ganj, Lucknow.
5. Dr. R.V. SATHE,  
Grant Medical College, Bombay.
6. Dr. K. VENKATRAMAN,  
Serologist, Government of India,  
3, Kyd Street, Calcutta.
7. Dr. S.C. SEAL,  
All-India Institute of Hygiene and Public Health,  
Calcutta.
8. Dr. C.V. RAMCHANDANI,  
Deputy Director,  
Indian Council of Medical Research,  
New Delhi. (Member-Secretary)

### Representatives of the States Expert Committees

9. Dr. C.R. NAIDU,  
Director of Public Health,  
Hyderabad, Andhra Pradesh.
10. Dr. D.N. PHUKAN,  
Professor of Social & Preventive Medicine,  
Assam Medical College,  
Dibrugarh, Assam.
11. Dr. S.R. CHATTERJEE,  
Deputy Director of Health Services,  
Bihar.

12. Dr. M.S. BOPARAI,  
Municipal Health Officer,  
Delhi Corporation, Delhi.
13. Lt.-Col. P. CHANDRA,  
Director of Health Services,  
Simla, Himachal Pradesh.
14. Dr. R. SANKARARAMAN,  
Deputy Director of Health Services,  
Kerala.
15. Dr. A.M. FRANCIS,  
Assistant Director of Public Health (Epidemics),  
Madras.
16. Dr. G.L. SHARMA,  
Director of Medical Services,  
Indore, Madhya Pradesh.
17. Dr. BABU LAL VERMA,  
Assistant Director of Health Services,  
Indore, Madhya Pradesh.
18. Dr. S.D. NARAYANA GOWDA,  
Superintendent,  
Bureau of Epidemiology,  
Mysore.
19. Dr. N. PATTANAYAK,  
Joint Director of Health Services,  
Orissa.
20. Dr. D.D. SHARMA,  
Joint Director of Health Services.  
Chandigarh, Punjab.
21. Dr. SATYA DEO ARYA,  
Deputy Director of Health Services,  
Jaipur, Rajasthan.
22. Dr. R.S. BHATNAGAR,  
Assistant Director of Health Services,  
Jaipur, Rajasthan.
23. Dr. P.K. TOPA,  
Assistant Director,  
Medical and Health Services, State Vaccine Institute,  
Patwadangar, Nainital, Uttar Pradesh.
24. Dr. SAROJ KUMAR CHATTERJEE,  
Deputy Director of Health Services,  
Calcutta, West Bengal.

## FOREWORD

THE rise in the incidence of smallpox came to the notice of the Union Ministry of Health in the early part of the year 1958. At the same time, the Ministry noticed that outbreaks of cholera in sporadic form had occurred in certain States of India. Judging from past experience, the Ministry apprehended large scale epidemics of these diseases during 1958, if adequate preventive measures were not taken to ward off such an eventuality.

Accordingly, the Union Ministry of Health addressed all States Governments and Administrations, vide its Letter No. F. 9-2/58-PH., dated 1st April, 1958, apprising them of the prevailing position of smallpox and cholera in the country and suggesting adoption of timely preventive measures to meet the challenge of these two diseases. Another suggestion to the States Governments was to consider the desirability of forming Expert Committees to examine in detail all the aspects of smallpox and cholera, recommended measures for combating them and also indicate ways and means for their ultimate eradication from the country. The Ministry asked the Indian Council of Medical Research, at the same time, to form a Central Expert Committee in order to collaborate with States Expert Committees in a concerted action against the two diseases.

The Central Expert Committee was formed in May, 1958. The Expert Committees in the States were formed on the dates indicated below :-

Bihar	9- 6-1958	Orissa	11-10-1958
Uttar Pradesh	10- 6-1958	Bombay	October 1958
West Bengal	21- 6-1958	Madras	9-12-1958
Andhra Pradesh	23- 6-1958	Mysore	7- 1-1959
Rajasthan	31- 7-1958	Madhya Pradesh	17- 1-1959
Kerala	8- 8-1958	Punjab	6- 2-1959
Assam	25- 9-1958	Jammu & Kashmir	No information

The Central Expert Committee, after arranging collection of preliminary data in respect of smallpox and cholera from the States Administrative Medical Officers and the States Expert Committees formed up to end of September, 1958, decided to hold its first meeting on 5th October, 1958, without waiting for the formation of expert committees in all the States. Its second meeting was held on 6th October, 1958, and the third on 11th October, 1958.

The Central Committee made a detailed examination of the situation and the minutes of its three meetings were sent to all the States for the information of their respective Expert Committees. It then decided to hold a joint meeting with the representatives of the States Expert Committees. Each State was accordingly requested to send a representative of its Expert Committee to attend the joint

meeting in New Delhi on 16th, 17th, 18th and 19th February, 1959. This meeting took place on the scheduled dates and, at the conclusion of the deliberations, the Chairman reviewed the whole position and summarised the views expressed and recommendations made in regard to the control and eradication of smallpox and cholera. A note containing the record of the Chairman's review was sent to the participants for their comments and for the purpose of bringing its contents to the notice of their respective expert committees. A final report has been prepared after taking into account the comments received from the participants.

The Central Committee expresses its thanks to the participating members from the States for the various memoranda submitted by them and for their helpful suggestions and co-operation at every stage of the deliberations.

New Delhi  
1st June, 1959.

C.G. PANDIT  
*Chairman,*  
Central Expert Committee.

C.V. RAMCHANDANI  
*Member-Secretary,*  
Central Expert Committee.



PART I

REPORT OF THE JOINT COMMITTEE  
IN REGARD TO  
CONTROL AND ERADICATION OF  
SMALLPOX





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## I. PREAMBLE

. Smallpox hits the headlines now and again when epidemics of frightening proportions overtake the Indian people in different parts of the country. But continuously, though not always heavily, the virus of smallpox keeps taking toll of life. Its ubiquity keeps the public health authorities alive to their responsibility towards the people, which results, regrettably, only in routine and imperfectly planned efforts in the control of the disease.

The problem of smallpox has been occupying the attention of the World Health Organisation for some time and that Body, at its Eleventh Assembly in June, 1958, passed a resolution which highlights this problem and recommends to all member governments expeditious measures to eradicate smallpox. In W.H.O. document EB 23/43 dated 16th December, 1958, which contains a review of the position of smallpox as it exists in the world today, it is stated that India and East Pakistan constitute by far the most important focus of smallpox in the world, and, with Burma, must be regarded as the most likely sources from which smallpox might be re-imported into those countries which, by sustained efforts, have got rid of it.

The document further states that smallpox was mildly endemic in the United States of America before the war, but, in the last few years, planned mass vaccination programmes had given "classic demonstrations" of the efficacy of this measure. In Columbia, it says, a nation-wide vaccination campaign was instituted in October, 1955, with the object of vaccinating at least 80 per cent of the population in five years ; in Peru, the campaign begun in 1950, covered 78.7 per cent of the population ; in Mexico the whole population was claimed to have been vaccinated in 1950 ; in Chile, the success of the vaccination campaign was obvious from the fact that there had been no case of smallpox since 1953. The document adds that it is understood that the U.S.S.R. and Czechoslovakia have succeeded in freeing their territories of smallpox ; the usual technique of mass vaccination campaigns in the Americas has been to carry out house-to-house vaccination and collection of large numbers of people at pre-arranged places and times has also been resorted to successfully.

The facts mentioned above fully justify the belief that smallpox can definitely be eradicated from areas where it is now prevalent. If eradication has been achieved by other countries, there is every reason to believe that India can do likewise. But, in India, the magnitude of the problem and the size of the country make it obvious that efforts in the eradication of smallpox must of necessity be proportionately large and supported by correspondingly large funds.

It may be stated that the member countries of the W.H.O. are committed to a programme of smallpox eradication. The Indian delegation to the Eleventh Assembly

supported the smallpox eradication resolution and expressed a hope that a time-limit would be set for the completion of the eradication programme, as otherwise the necessary action might not be taken as expeditiously as was desirable.

The knowledge of measures to deal with smallpox now available, if properly applied, will bring about the control and ultimate eradication of the disease, and the time and atmosphere would appear to be right for an all-out effort in that direction. Germane to this issue is the point to remember that, in spite of the apprehension of some workers that the recent increase in the incidence of smallpox incidence might possibly be due to a different strain of smallpox virus in the country—for this fear there is no justification in the absence of any definite scientific evidence—the programme of eradication should be launched with full confidence in the effectiveness of vaccination with lymph that India produces provided that lymph conforms to accepted standards.

## II. INCIDENCE OF SMALLPOX IN INDIA

The incidence of smallpox in different States of India in the last ten years is given in Appendix I. The number of vaccinations and revaccinations performed in each State during that period is also given. The figures of weekly attacks and deaths during the years 1956, 1957 and 1958 are plotted in Charts I to III, while the rate of incidence in different States in the last 13 years is given in Charts IV and V.

From the study of the charts certain broad conclusions can be drawn. It would appear that smallpox shows a definite seasonal prevalence and that the incidence reaches epidemic proportions during the first six months of the year. It may, however, be mentioned that, when the total incidence of smallpox in the country in any one year is low, it is low in almost all the States; and when the total incidence is high, the magnitude of infection in several States is also high.

Another interesting feature that is noticeable from Appendix I is that smallpox generally shows periodicity, the incidence being significantly high every five or six years. This has been attributed by public health authorities to the accumulation of susceptibles as a result of faulty registration of births leading to non-vaccination of un-registered infants, indifferent techniques of vaccination, waning immunity after primary vaccination, and absence of a definite programme of revaccination.

The figures of the incidence of smallpox in different age groups are not readily available in respect of several States. Studies conducted in U.P. have shown some significant trends. In the following table, the relative percentages of deaths from smallpox in the age groups 0—1, 1—10, and the group containing all others above 10, for the quinquennial periods beginning from 1895, are given.

It will be seen that there has been a gradual decline in the percentage of deaths in the first two age groups with a relative increase in the age group '11 and

TABLE

*Smallpox mortality in Uttar Pradesh\* according to age groups (1895-1954)*

Period	Percentage of total smallpox deaths.		
	0—1	1—10	11 and above
1895—99	32	56	12
1900—04	38	51	11
1905—09	32.5	51	16.5
1910—14	33	57	10
1915—19	32	49	19
1920—24	26	48	26
1925—29	29	46.5	24.5
1930—34	26	40	34
1935—39	24	32.5	43.5
1940—44	18	27	55
1945—49	24	30.5	45.5
1950—54	18.5	24.5	57.0

\* Smallpox in U.P. by K.M. Lal and G.S. Murty. *J. Ind. Med. Assoc.*, 1958, Vol. XXX, pp. 120-126.

above'. This gradual decline in the death rate among young children can be attributed to an effective programme of primary vaccination, while the increase in the age group '11 and above' is an indication of waning immunity after primary vaccination. This points to the need for revaccination.

Experience in West Bengal has been more or less the same as in U.P., but here the change has been more striking since 1953. In that year, the percentage of deaths in the age groups below 10 years was 54, while in 1957 it was only 19.8. Study of figures of mortality from smallpox in other States to obtain comparable information seems to be desirable.

When figures of primary vaccinations and revaccinations are considered, it appears that a very large effort is made in each State every year. While this can be assumed to be the cause of a general lowering of the magnitude of the epidemics of smallpox during recent years, the total gain is not commensurate with the vaccinations performed. This state of affairs would justify the belief that there are lacunæ in the present vaccination programmes.

### III. REGISTRATION OF BIRTHS AND DEATHS

The importance of accurate registration of births and deaths cannot be overstressed. Unless it is known how many babies have been born, it cannot be made certain that primary vaccination has been carried out with cent per cent coverage. Deaths, if registered disease-wise, would help focus attention on preventable diseases that take heavy toll of life and would enable the public health authorities to take appropriate control measures.

The present position in respect of registration of births and deaths, indicated below State-wise, is far from satisfactory. With the exception of one or two, the States have not yet been able to organise collection of this vital information in a satisfactory manner.

#### Andhra Pradesh

This State comprises 11 districts which belonged to Madras State and 9 districts of Telangana which formed part of Hyderabad State prior to re-organisation of States. Compulsory registration of births and deaths in the 11 districts mentioned first is in force under the Madras Registration of Births and Deaths Act of 1899. In the rural areas, the village Munsif is the Registrar and works under the Collector. In the municipal areas, the Sanitary Inspectors function as Registrars for every 20,000 of the population. In regard to the 9 districts of Telangana, compulsory registration has been in force in the rural areas from 1st January, 1955. The Police "Patel", belonging to the Revenue Department, is the Registrar. In the municipal areas, Sanitary Inspectors act as Registrars. As these officials have to tour a great deal in the discharge of their executive duties, they are not always readily available for purposes of registering births and deaths and, therefore, registration is defective. In Telangana, in the city corporation of Hyderabad, there is no exclusive Registrar and the Sanitary Inspectors are made to undertake the duty of registration. This state of affairs is not satisfactory and leads to accumulation of unprotected children which results, every three to four years, in outbreaks of smallpox in epidemic form.

#### Assam

In this State, the Births and Deaths Registration Act of 1935 has been in force since 1st January, 1936, in areas where the Bengal Births and Deaths Registration Act of 1873 was previously operating. The Local Government has power to extend the provisions of this Act to any other part of the State where the Bengal Act is not in force. The Act provides that the father or mother of every child that is born, or, in case of death, illness, or inability, of the parents, the midwife assisting at the birth of such a child, should give information personally or in writing to the Registrar within 8 days of the occurrence of birth. The District Magistrate or the Deputy Commissioner has power to divide the area in his jurisdiction in convenient

circles and appoint one or more persons in each circle to function as Registrar/Registrars of births and deaths. The Registrars have to maintain their offices and register births and deaths *without fee or reward*. In rural areas, for one large village or one group of small villages there is a headman "Gaon Bura". He is appointed by the Deputy Commissioner to record births and deaths. He reports the vital occurrences at the end of each month to the Registrar or "Mouzadar". The Registrar then sends a consolidated return to the District Medical Officer of Health (now Civil Surgeon). The latter, in turn, sends one return of vital occurrences every month to the Director of Health Services.

### **Bengal**

The Bengal Births and Deaths Registration Act of 1873 is in force in the State. This makes the registration of vital events compulsory both in rural and urban areas. The Rural Medical Officers of Health, Officers in charge of Health Centres and Sanitary Inspectors function as Registrars of births and deaths. In municipalities, the Chairmen are the Registrars. The information is collected by "Chowkidars" and "Dafadars" in rural areas and by the Municipal Commissioners, Vaccinators and Midwives in urban areas. The Government of West Bengal is understood to have taken steps for improving registration of births and deaths under their scheme of Central Compilation of Health Statistics. Inspecting staff to detect omissions in registration and guide the local reporters and registrars in the proper collection and registration of vital events will also be provided.

### **Bihar**

The Bengal Births and Deaths Registration Act of 1873 is utilised in Bihar and registration of vital events is compulsory both in rural and urban areas. Village "Chowkidars" collect information about vital occurrences and forward it to Thana Officers who are the Registrars of births and deaths. The Thana Officers send consolidated monthly reports to the Civil Surgeon. In urban areas, "Beat Jamadars" collect data and submit them to the Health Officers, who, in turn, forward the information to the Civil Surgeons. The Civil Surgeons then pass on the entire information every month to the Directorate of Central Bureau of Economics and Statistics.

Areas covered by Gram Panchayats have been declared as registration districts and the Gram Sevaks (Secretaries of the Gram Panchayats) have been notified as Registrars of births and deaths. The Gram Panchayats send information in the prescribed form to the District Statistical Officer who compiles figures for the whole district and sends a statement to the Directorate of the Bureau mentioned above.

### **Bombay**

In the urban areas, registration of births is carried out by the Municipal Authorities, most of which have their own bye-laws under the relevant Municipal

Act for compulsory registration of births. The system, it is stated, has been working satisfactorily. There are, however, still Municipalities which have not framed their bye-laws in respect of this matter and it is in their jurisdiction that the system of registration is unsatisfactory. The Government of Bombay is understood to have taken steps to advise such Municipalities to frame the necessary bye-laws at an early date.

In regard to rural areas, the registration of births is done by the village Police "Patels" under the administrative orders of the Government of Bombay. The system seems to be working satisfactorily. Touring Public Health Officers make efforts to detect omissions in registration of births by verifying the entries in births and deaths registers maintained in the villages. The vaccinators also do verification work. The system is reported to be functioning satisfactorily.

### **Kerala**

In this State it has been obligatory on the part of parents to present to the school authorities birth certificate of a child at the time of seeking admission of that child to a primary school. The adoption of this procedure led to the introduction of registration of births, which, till four years ago, was done by the revenue authorities. The Public Health Department then took over this function. The registration of births under the Public Health Authorities is now carried out by the Health Assistants. In the Malabar area, the Revenue Authorities continue to register births, a practice prevalent in old Madras State. A comparison of the results of registration by the two different authorities has shown very little difference in the accuracy of records.

### **Madhya Pradesh**

Registration of births and deaths is understood to be defective, the reporting agency being a village "Chowkidar".

### **Madras**

This State has Registrars of births and deaths or Registrar Vaccinators in all the urban areas. The work of the former is so arranged that their offices are kept open for registration of vital events either in the forenoons or afternoons and the check-up of the reports of vital events is carried out during that period of the working day when the offices are closed. The Registrar Vaccinators, on the other hand, carry out vaccinations in the forenoons only and do the registration work in their offices in the afternoons.

The rural areas are dealt with in a different manner. The village Headman is the Registrar of Births and Deaths. He is usually a man of some education and good economic status, and wields local influence. The headmanship is usually hereditary and carries great prestige and influence. The Headman may be made responsible for one village or a group of houses in a large village. Sometimes the



registration unit may consist of two or more hamlets of 50 to 100 houses each, situated at a distance of quarter to half mile from the main village. As the village Headman has other duties to perform at the same time, the registration of vital events is not satisfactory. The supervision of registration work is carried out by the Health Inspector when he visits the village hamlets for verification of vaccinations. The Health Assistant also, during routine primary vaccination or revaccination, carries out supervisory work. These two supervisory officials send information about vital events and report cases which are missed out to the District Health Officers and other inspecting officers.

The registration of vital events in Kanyakumari district of Madras State, previously of old Travancore-Cochin State, is carried out by Health Assistants and not by village Headman. Each Health Assistant is placed in charge of about 10,000 to 15,000 population.

### **Mysore**

This State utilises the Registration of Births, Deaths and Marriages Act. Its Director of Public Health is the Registrar General and the village Headmen and Municipal Health Inspectors are the Registrars of Births and Deaths.

Monthly returns of births and deaths are sent by the village Headman to the Tehsildar, who, in turn, sends them to the State's Statistician. The Statistician compiles the figures and sends them to the Registrar General.

The Presidents of municipalities send the daily returns to the State's Statistician who processes them to the Registrar General.

The responsibility for reporting births and deaths is placed on the parents, the relatives, the occupier of the house, etc. and the report has to be made within a specified period of time after the occurrence of the event.

Mysore State has a new Births, Deaths and Marriages Registration Act ready, which will cover the entire newly-constituted State. It is proposed to provide in this Act for the production of a birth certificate at the time of admission of a child to school for the first time.

The supervision of the Registrar's work in rural areas is carried out by officials of the Revenue Department. In the Health Unit area, the Health Inspector collects information about vital events, compares his figures with those registered by the Patels and has the necessary corrections carried out in the subsequent month, if any discrepancies are noticed.

### **Orissa**

In South Orissa, comprising Ganjam and Koraput districts, the Madras Births and Deaths Registration Act is in force, but it is applicable only to the rural areas of Ganjam plains. It is not in force in the Koraput district and Ganjam Agency tracts. Information about vital events is collected by the police and the health

officials. The parents or relations furnish information to the police on a voluntary basis.

The Madras District Municipalities Act, which was in force in the urban areas of the districts mentioned above, has been replaced by the Orissa Municipal Act of 1950. This Act does not provide for registration of births and deaths. The people furnish information voluntarily and the Health Staff collect it by door-to-door visits at the time of their vaccination operations.

In the rural areas of Ganjam plains, the village officers maintain births and deaths registers, furnish monthly statistics to the tehsildar, who, in turn, sends the information to the Director of Health Services.

In Koraput district and Ganjam agency areas, the figures of vital events collected by the police are compiled and sent to the District Health Officer.

In North Orissa, the Bengal Births and Deaths Registration Act is in force in the urban areas and the Bengal Village Chowkidary Act of 1870 operates in the rural areas of some districts. The "Chowkidars" collect information about vital events in the rural areas and send it to the Thana Officers on the parade day held once a week or fortnight. The Thana Officers compile the information and send it to the District Health Officers.

In the urban areas, the Health Officer functions as the Registrar of births and deaths. He is assisted by Sub-Registrars.

No Act is in force in the ceded districts, but the information is collected by the police through the "Chowkidars" and forwarded to the District Health Officers. The supervision of the village officers' work is carried out by the health officials.

### **Punjab**

The registration of births in the rural areas is carried out by the village "Chowkidars" on Thana basis. In the urban areas, the Municipalities register births and deaths. The members of the supervisory staff of the Health Department look for omissions in registration and correct errors. The system has not been found satisfactory and there is a move to have registration circles in the rural areas organised on Block basis in order to remove the defects in the present system.

### **Rajasthan**

Before Rajasthan, as it exists today, came to be formed, each of the 18 merging States had its own laws in regard to registration of births and deaths. On integration, the individual Acts of these States were repealed and a unified Birth and Death Registration Bill was prepared. This was recently passed by the Rajasthan Legislative Assembly as the Births, Deaths and Marriages Registration Act. The Act, however, does not provide for compulsory reporting of vital events and the registrations are made voluntary. The Government of Rajasthan has since appointed a Committee to go into the question of amendments to this Act and that Committee has suggested *inter alia* that registration must be made compulsory.

#### IV. EXISTING LEGAL PROVISIONS REGARDING PRIMARY VACCINATION AND REVACCINATION

The position in regard to legal powers for enforcing primary vaccination and revaccination varies from State to State. Available information shows that :

In the State of Andhra Pradesh, both primary vaccination and revaccination are compulsory in the Andhra and Telangana areas under the relevant Vaccination Acts.

In Assam, there is no legal provision for making vaccination compulsory at all times. Temporary regulations are made and enforced at the time of epidemics. Vaccination is made compulsory in affected areas for a period to cover the emergency.

In Bihar, primary vaccination is compulsory under the Bengal Vaccination Act, while revaccination is not compulsory.

In the newly-formed Bombay State, primary vaccination is compulsory in the constituent areas where the Vaccination Acts have been made applicable, but there is no legal provision for compulsory revaccination. Primary vaccination, it may be stated, has not been made compulsory in the entire State due to the unsatisfactory financial position of many local bodies which are required to arrange for vaccinations.

In Delhi, the Vaccination Act of 1880 is in force throughout the territory and the Madras Revaccination Act (Madras Act V of 1920) is enforced in the urban areas, making revaccination compulsory.

In Madras State, both primary vaccination and revaccination are compulsory under the provisions of the Madras District Boards, Madras District Municipalities, and the Madras City Municipal Acts.

In Mysore, only primary vaccination is compulsory in cities, towns, and 5,600 villages. Powers are taken under the Public Health Act during epidemic seasons, when both primary vaccination and revaccination are made compulsory in the infected and threatened areas.

In Rajasthan, the Rajasthan Vaccination Act, which provides for compulsory primary vaccination, was promulgated recently. Revaccination is not compulsory, but school-going children are usually revaccinated at intervals of three to five years. Others are also revaccinated by persuasive propaganda. During epidemics, however, the Epidemic Diseases Act is enforced over the affected areas and revaccination is made compulsory.

In Orissa, the Bengal Vaccination Act of 1880 is in force in urban and rural areas of the districts of Cuttack, Puri and Balasore. This Act provides for compulsory primary vaccination but not for revaccination. In the rural areas of Ganjam plains, however, the Madras Local Boards Act is in force which provides both for compulsory primary vaccination and revaccination. In addition,

temporary regulations under the Epidemic Diseases Act of 1897 are enforced in all the districts, as and when necessary, making primary vaccination and revaccination compulsory.

In the Punjab, both primary vaccination and revaccination are compulsory under the Punjab Vaccination Act of 1953.

In Uttar Pradesh, vaccination is compulsory under the Vaccination Act of 1880 only in urban areas and optional in rural areas.

In West Bengal, the Bengal Vaccination Act is utilized for making vaccination compulsory at the time of epidemics and at other times if considered necessary, but there is no provision for compulsory revaccination. This deficiency is made good by promulgating temporary regulations under the Epidemic Diseases Act which is usually enforced in anticipation of an outbreak.

## V. PRESENT METHODS OF CONTROL OF SMALLPOX

### (1) MANUFACTURE AND SUPPLY OF VACCINE LYMPH

Vaccine lymph is manufactured in 12 centres situated in 11 different States. In most centers, calves are used for the production of lymph. In one or two States, sheep are also used for production of vaccine lymph. As a rule, the quantity of lymph manufactured meets the normal requirements of each State.

The States of Rajasthan, Orissa, and Jammu and Kashmir do not manufacture vaccine lymph but obtain it from the neighbouring States. The actual quantities manufactured by the States are given in Appendix II of this report.

Vaccine lymph is generally issued from the manufacturing centres directly to the Vaccinators working in the field according to a pre-arranged programme except in U.P. where it is issued in the first instance to municipal medical officers of health for use in cities and to district medical officers of health for use in villages. In some States, there seems to be a need for improvement in the planning of such distribution programmes. There are no subsidiary storage depots in most of the States. Mysore has four.

### (2) ADMINISTRATION OF VACCINATION PROGRAMMES

(a) *Control of vaccination programmes*—The Committee noted that the control of vaccination programmes was exercised by different authorities—Governmental, District Boards, Municipalities and Notified Area Committees. The efficiency with which these authorities organised vaccination programmes was understood to vary considerably and, more often than not, the results were unsatisfactory. On occasions, the Committee understood, the head of a local body would turn out to be a conscientious objector and the organisation of a vaccination campaign under his direction would inevitably lack drive and force.

(b) *Training of Vaccinators*—The training of Vaccinators is carried out for varying periods in different States. The position is as follows :—

In Andhra Pradesh, there used to be a six months' training course for Vaccinators. This course has been suspended and Health Assistants are being trained instead, their course of training lasting one year. These Health Assistants later on become Health Inspectors.

In Uttar Pradesh, young men having read upto 7th class are admitted to a six months' training course in vaccination and, after satisfying the District Medical Officer about their proficiency, are made permanent. However, this has not been found satisfactory. There is a proposal to admit only matriculates to the Vaccinators' class and give them two months' training at the Provincial Training Institute at Lucknow and four months' training in the field. They will be called Health Assistants and would subsequently be selected for training as Health Inspectors.

Bihar recruits young men, who have passed their middle vernacular and have a fair knowledge of Hindi, both in reading and writing, for training as Vaccinators. They are trained for one month.

In Orissa, there is a three months' course of training for Vaccinators and only those who have passed middle English are admitted to this course. One month is devoted to theoretical training and two months to practical training.

Madras State, like Andhra, has stopped appointing Vaccinators. Qualified Sanitary Inspectors are engaged as Health Assistants and are required to carry out vaccination work. In emergencies, Vaccinators are also employed. The Health Assistants are later promoted to Health Inspectors' posts. The training of these Health Assistants lasts one year.

Himachal Pradesh does not insist on any educational qualification for admission to the course of training in vaccination which lasts for three months. The trainees are made to sit for an examination at the end of that period.

Kerala employs Health Assistants who are made to do vaccination work. These Health Assistants receive nine months' training.

In the Punjab, Sanitary Inspectors, whose training course is of one year's duration, are given four months' training in vaccination work, one month in theory at a vaccination institute and three months in the field.

Assam has a system of its own. Three categories of personnel are employed for vaccination work. They are :—

- (i) The seasonal Vaccinators, who are employed by the district boards for six months and whose training is organised by placing them as under-studies to trained Vaccinators. They are given employment after passing a test. The period of under-study lasts three months. Their basic qualification is middle vernacular. After six months they go back to their fields because they are usually cultivators by profession.

- (ii) Health Assistants, who are recruited for anti-smallpox campaigns. They receive three months training under the District Medical Officers of Health.
- (iii) Sanitary Inspectors, who are really Health Assistants, are given nine months' training before they are designated Sanitary Inspectors.

In West Bengal also there are three categories of personnel who do vaccination work :—

- (i) Vaccinators
- (ii) Health Assistants
- (iii) Sanitary Inspectors

The practice of engaging Vaccinators has been almost abolished. Some of the Vaccinators employed by the District Boards have had three months' training and they are admitted to the course if they have passed 8th class. The Health Assistants get six months' training which is followed by an examination. They are admitted to the course when they are at least matriculates. The Sanitary Inspectors, at least matriculates or preferably inter-science passed, are given nine months' training. The Sanitary Inspectors' training course at the moment is in abeyance, as there are more Sanitary Inspectors than can be found jobs.

In Rajasthan, there is a permanent cadre of Vaccinators and their basic qualification is middle vernacular. Their training period is of three months duration. Latterly, they have started training Sanitary Inspectors whose course of training lasts nine months. The Sanitary Inspectors do vaccination work only when necessary and in emergencies.

- (c) Supervision of Vaccinators' work—Supervision of the work of the Vaccinators is not organized on a satisfactory basis in the States. There are different practices prevailing in this regard. Some instances are given below :—

In Andhra Pradesh, the Sanitary Inspectors supervise the work of Vaccinators.

In Madras State, the supervision of the work of vaccinators is carried out as follows :—

In rural areas the vaccinators work directly under the Range Health Inspectors and the Range Health Inspectors verify 70 per cent of the primary vaccinations and 50 per cent of revaccinations. In urban areas (Municipal) the Registrar Vaccinators work directly under the Health Officer and they verify their own work. However, the Health Officer has to check 25 per cent of the vaccinations to satisfy himself about the quality of work of the vaccinators.

In Mysore, a Vaccinator checks his own work and maintains record in a register kept for that purpose. The Health Inspector then goes and checks 60 per cent of the primary vaccinations and 30 per cent of revaccinations to satisfy himself as to the correctness of the entries made by the Vaccinator.

In Uttar Pradesh, the Vaccinator records and assesses his own vaccination work but, in each district, there is an Assistant Superintendent of Vaccinations. It is the primary duty of this official to check the work of the Vaccinators.

In Bihar, there is a special Inspector of Vaccination, but no fresh recruitment to this cadre is being made. Vaccination work is now being supervised by Health Inspectors. Sanitary Inspectors also do supervision of vaccinations.

In Orissa, supervision of vaccination is done by the District and Municipal Health Officers, Health Inspectors and other supervisory staff. One Health Inspector supervises the work of 2 to 3 Vaccinators in the rural areas. The Vaccinator himself verifies vaccinations performed by him. The Health Inspectors are required to do check verification of 60 per cent of primary vaccinations and 30 per cent of revaccinations. No targets have been fixed for other supervisory officers. From the Director of Health Services downwards, all do sample check verification.

In Rajasthan, the Vaccinator maintains record of his own work, and results of 50 per cent of primary vaccinations and 30 per cent of revaccinations are checked by higher inspecting officials.

In the Punjab, the Vaccinator enters the results of vaccination carried out by him in the register maintained for the purpose, and the Superintendent of vaccinations checks them and makes appropriate remarks in blue ink.

## **VI. STEPS TAKEN BY STATES TO INTENSIFY VACCINATION PROGRAMMES**

Many States have taken or are contemplating to take steps to intensify their vaccination programmes for the control of smallpox. In Uttar Pradesh, while considering long-term measures for the control of smallpox, including the introduction of compulsory primary vaccination and revaccination, and streamlining of the organisation for efficient administration of the vaccination programmes, a short-term programme is envisaged.

It is proposed to divide the State into three zones. An intensive vaccination drive is to be conducted in each zone every fourth year, mobilising for the purpose the staff from existing sources. The Public Health Authorities of the State have drawn up in this connection a programme of "piecemeal" vaccination to be pursued till the necessary finances become available for a mass vaccination programme. The details of this "piecemeal" programme are given in Appendix III.

In Bombay State, a "voluntary" mass vaccination programme has been introduced since 1954, the idea being to vaccinate 1/5th or so of the population in old Bombay State within a year and to cover the entire State within a period of 4 to 5 years. It is understood that, by 1957, 50 per cent of the population, particularly individuals below 35 years of age, had been vaccinated.

In the State of Madras, where primary vaccination and revaccination are compulsory, the programme in respect of rural areas is to cover 10 per cent of the villages each year. The entire State is to be covered within a period of 10 years. This programme is considered well within the financial resources of the State. To ensure the success of the programme, various registers are maintained at the village level, such as the unprotected children's register (UPC) and unprotected persons' register (UPP). Provision also exists for house-to-house verification of vaccination results.

In Bihar, mass vaccination programme for rural areas was initiated in 1954 with a view to vaccinating the entire population within a reasonable period. It is understood that 60 per cent of the population has been covered by now.

In Orissa, mass vaccination campaign has been in operation since the middle of 1958. Under this programme, survey of unprotected children and persons and vaccination of 1/5th of the population each year has been planned. The scheme aims at complete immunization of the most vulnerable group. One Vaccinator is attached to each vaccination circle to conduct a door-to-door survey and maintain records of unprotected children and persons.

In Mysore, a mass vaccination campaign in the taluks of old Mysore State has been in operation for the last 7 to 8 years in order to rectify the deficiencies in primary vaccinations and revaccinations in the district board areas. For this purpose, the vaccination staff of an entire district is mobilised at a time for work in one taluk. The existence of a large number of primary health units in the area facilitates the execution of the programme. Family registers are maintained in the Health Unit area which help in keeping track for vaccination purposes of unprotected children before they attain the age of six months. Revaccination of 1/5th of the population is also attempted each year. Completion of vaccination of the entire population of one village in one day is aimed at, and one Vaccinator is expected to vaccinate 150 persons in a day. Many difficulties have been experienced in the conduct of the campaign, and it has not been possible to complete the programme according to schedule, mainly for want of adequate staff needed for the purpose. The details of a mass vaccination campaign carried out on the lines mentioned above in 9 taluks are given in Appendix IV. The total cost of this operation is approximately Rs. 26,800.

In other States, while no intensive programmes of the type described above have been attempted, steps have been taken to improve vaccination work by increasing the number of Vaccinators per unit of population (1 Vaccinator for about 20,000 of population). Steps are also being taken to enact suitable legislation to make primary vaccination, and later on revaccination also, compulsory. However, it is obvious that concurrent action by all the States is essential if the ultimate goal of eradication of smallpox from the country is to be achieved.



## VII. RECOMMENDATIONS

Examination of the present methods of control of smallpox adopted by different States has brought to light numerous shortcomings that account for the inadequate control of the disease. There seems to be a need for an alround improvement in the administration of vaccination programmes as well as for enacting suitable legislation making both primary vaccination and revaccination compulsory. While many States have initiated, during the last four or five years, energetic measures for the control of smallpox, those measures, it is felt, may not succeed in eradicating the disease as quickly as is desirable. When this point was discussed, a view was expressed that there was need for taking simultaneous action in all the States in order to bring the disease under effective control. The Committee took note of the suggestions received in regard to the measures for dealing with smallpox and wished to recommend those which would lead to improvement in the general administration of vaccination programmes and help in eradicating the disease. The recommendations, will be given under two main heads. Under one will be recommendations of a general nature which will improve the vaccination programmes, and under the other will be specific recommendations for the control and ultimate eradication of smallpox. It must be pointed out that, when recommendations under the first head are properly implemented, it would be possible to maintain the immunity of the population at the desired level. That is essential when once the disease has been eradicated from the country.

### I. General Recommendations

#### (1) REGISTRATION OF BIRTHS AND DEATHS

It will be noticed that the practice of registration of births and deaths is not uniform throughout the country. Even in the individual States recently reorganised, the practice in the component parts is that which prevailed in the original parent States of those parts. In view of this multiplicity of practices resulting in unsatisfactory registration of births and deaths, and with the object of improving the situation, the Committee recommends :—

- (a) that there should be an Act making registration of vital events compulsory and that that Act should legislate for :
  - (i) the provision of proper facilities for registration
  - (ii) setting up of registering offices easily accessible to those reporting vital events
  - (iii) awarding of punishment for lapses in the duties of reporting or recording of vital events ;
- (b) that the Secretary of Gram Panchayat should be appointed Registrar of births and deaths for his area ;

- (c) that the Secretary of Gram Panchayat should send figures of vital statistics to the Block office from where such information could be forwarded to the Sub-division or District office for early transmission to the District Health Officer ;
- (d) that arrangements should be made for the peripheral reporting officials to send information about births and deaths by post on unstamped cards, the postage charges being recoverable by the postal authorities later on in consolidated amounts in a manner similar to the one adopted in respect of commercial concerns ; or perhaps, the Committee felt, the Centre could give exemption from affixing of postage stamps on communications notifying births and deaths ;
- (e) that the village registers containing family-wise records of vital events should be preserved ;
- (f) that the officers of the health administration should have the right to inspect these registers ;
- (g) that before a child is admitted to a primary school, even in the villages, the parents should be required to produce a certificate of his/her birth. Such a practice, the Committee felt, would compel the parents to have the births of their children registered ;
- (h) that the power to prosecute for lapses in reporting or registration of vital events should vest in the District Health Officers instead of the Tehsildars.

(2) LEGAL PROVISIONS FOR ENSURING PROMPT ACTION IN FIGHTING EPIDEMICS  
OF SMALLPOX

From a general discussion on this subject it became apparent that legal provisions exist in all the States for use when required. Some considered those provisions ample, but most of them felt that there should be an Act applicable throughout the country, with provision for allowing such changes as the local conditions of the States may necessitate. It was pointed out that the Central Council of Health has been seized of this matter for the last five years and has sent out a Model Public Health Act to the States for their consideration. The States have been requested to scrutinise its provisions and get the Act passed by their respective legislatures after making modifications considered necessary to suit local conditions. A view was expressed that the Infectious Diseases Control Act, under consideration at present by the Union Government, should be promulgated, more or less on the lines of the Central Food Adulteration Act, to ensure uniform procedures all over the country in respect of smallpox. This Act was considered particularly desirable because the existing Epidemic Diseases Act did not operate between States.

While the fact was noted that legal provisions for enforcing vaccinations existed, their implementation, it was agreed, was not satisfactory. It was understood that in some areas even primary vaccination was not in force. As for revaccination in most States it was not compulsory, and it was gathered that the States' Expert Committees had recommended to their respective governments that it should be made compulsory. Discussing this question further, a view emerged that there should be a uniform law for the purpose and it was stated that the Model Public Health Act, which has been circulated for eliciting opinion, contains appropriate provisions.

It was pointed out that vaccination organisations at the present time were administered by different authorities, such as, municipalities, district boards and panchayats, and that this multiplicity of authorities was not conducive to successful vaccination drives.

After due consideration of the defects in the existing laws and practices in respect of measures for dealing with smallpox, the Committee recommends that :

- (i)\* a Central Infectious Diseases Control Act should be promulgated more or less on the lines of the Central Food Adulteration Act to ensure uniform procedures all over the country in respect of control of smallpox ;
- (ii) one authority in each State should be entrusted with the task of enforcement of legal provisions in respect of vaccination ; and
- (iii) both primary vaccination and revaccination should be made compulsory.

### (3) EARLY DETECTION AND NOTIFICATION OF CASES OF SMALLPOX

The *sine qua non* for the successful combating of outbreaks of infectious diseases is early spotting of cases and immediate notification to the health authorities concerned. Reporting, to be expeditious and reliable requires to be entrusted to persons fully conversant with the responsibility attached to that duty and duly aware of the importance of timely action in the interest of the community.

The present system of notification appears to be unsatisfactory and has many imperfections. Often enough, the individual responsible for notifying a case is casual in the discharge of his duty, frequently he is not familiar with the cardinal symptoms of the disease to enable him to make an approximately correct diagnosis; almost invariably the channel through which he has to send this necessary information is so devious that the essential object of getting the information to reach without delay the appropriate health authorities for timely action is defeated.

During the discussion of this subject, many suggestions were made for devising a system whereby early recognition of cases would become possible and reporting prompt. One was that the Secretaries of Gram Panchayats, who are paid officials, should be made responsible for transmitting information to the health

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\*This Act would deal with cholera also.

authorities; it was stated that, if adequate use is made of the village worker, he can be trusted with confidence to send early and correct information of occurrence of cases to the health authorities; such a person, it was emphasized, is constantly in touch with the public and would, therefore, get to know of the occurrence of cases at the earliest moment. Another suggestion was that some reward should be given to the person who gives first-hand information about cases. Yet another suggestion was that, in order to hasten the arrival of information at the office of the District Medical Officer of Health, printed and stamped post cards should be supplied to all the Patwaris in the district and they should be instructed to use them as and when required. The Patwaris would then send the information about the outbreaks of smallpox in their respective areas on these cards direct to the office of the District Medical Officer of Health. This system, understood to be working apparently well in one State, has been found helpful to some extent. A further suggestion was that the Collector of the District should be empowered to take very strict action against the village officials who delay sending in information of cases to the appropriate authorities and that *deterrent punishment*, having sanction of law, should be awarded to those who fail to report occurrence of cases in time. The importance of educative propaganda by means of talks, posters, pamphlets, etc., to focus attention of all concerned on the importance of prompt and correct reporting, was also stressed. Rewards in the form of cash or merit certificates were also suggested for those who performed their duties without avoidable delay.

In view of the importance of early recognition of cases, and taking into account the several views expressed in this regard, the Committee recommends that :

- (i) The responsibility of notification should be placed on the Panchayats, because the Chowkidar or the Gram Sevak or the Village Headman will all presumably be under the control of the Panchayat ;
- (ii) the Panchayat Secretary should transmit information to the health authorities by telegram, where a telegraph office exists, or by a special messenger when a telegram can not be sent, and the doctor in charge of the Primary Health Centre or the Sanitary Inspectors and the District Medical Officer of Health should be informed by him simultaneously ; and
- (iii) for the guidance of Chowkidars and others, special instructions should be prepared which would help them recognise cases and highlight the necessity of reporting them without delay.

#### (4) TECHNICAL ASPECTS OF VACCINE LYMPH MANUFACTURE

Vaccine lymph has to conform to the standards laid down in the Drugs Act of 1940. Standards for storage, purity and potency of lymph and specifications for containers, in which lymph is to be issued, are given.

(a) *Purity of lymph*—To ensure availability of lymph of a good standard of purity, a bacterial content of not more than 20,000 organisms per c. c. of lymph is

permitted, and different methods are utilised by vaccine producing establishments, such as, glycerination of lymph, its treatment with chloroform, or addition to it of antibiotics like penicillin and streptomycin, to attain that standard. However, in current practice, no attempt is made, except in a few States, to eliminate the pathogenic staphylococci. The Committee recommends that suitable laboratory procedures should be adopted for elimination of those organisms also.

(b) *Potency of lymph*—For the evaluation of the potency of lymph, not all laboratories use the same procedure. To secure uniformity in the potency of lymph and to know whether the lymph that has been issued has retained its potency during the period between its despatch and use, the Committee recommends that :—

- (i) Batches of lymph manufactured by different laboratories should be tested at a central place designated for the purpose as a reference laboratory, and
- (ii) arrangements should be made to return random samples of the lymph, issued for use in the field, to the issuing laboratory for retesting.

By adopting the two recommendations mentioned above, the Committee felt that it would become possible to take appropriate measures to remedy defects when noticed.

#### (5) UTILISATION OF LYMPH IN THE FIELD

(a) *Age of child when primary vaccination can be given*—The Committee, while recommending that the prevailing practice of giving primary vaccination to children within the age period of 4-6 months should be continued, saw no scientific reason why vaccination should not be performed even at an earlier age period, should that be necessary because of the presence of smallpox in the area.

(b) *Interval between primary vaccination and revaccination*—Recent studies have shown that immunity conferred by primary vaccination gradually diminishes. It is, therefore, necessary to boost up the immunity by periodic revaccinations. The Committee, therefore, recommends that :

The first revaccination should be done at the age of five and subsequent ones should be given every five years till age 15 is reached. Since primary education is going to be made universal and compulsory in the near future, arrangements could be made to vaccinate all children at the time of entry to school, again at age 10 and then at the time of leaving school.

(c) *Techniques of vaccination*—There are three methods commonly used in vaccination work, viz. (i) multiple pressure method, (ii) scarification with rotary lancet, and (iii) scarification with ordinary scalpel or a lancet.

The multiple pressure method has many advantages in that it causes the least amount of trauma and facilitates introduction of the vaccinia virus at proper

depth in the skin. However, good care has to be exercised in the procedure. It is also necessary to give special training to vaccinators in the use of this method.

The rotary lancet method has been in common use in the country for many years, is simple, and has stood the test of time. In view of this, the Committee recommends that :

While the multiple pressure method would normally be the method of choice for carrying out vaccinations, the rotary lancet technique should continue to be employed because of its simplicity and the familiarity of the vaccinators with its use. The Committee, however, *does not recommend* linear insertions with ordinary scalpel or lancet.

(d) *Number of insertions*—The Committee took note of the practices followed in different States in regard to the number of insertions made at the time of performing vaccination. In most States it is common to give four insertions, two on each arm. In a recent study conducted in Madras, it was observed that the degree of protection conferred by four insertions was higher than that afforded by two insertions. In other words, there was a direct relation between the total scar area resulting from vaccination operation and the degree of immunity conferred by vaccination. In view of this, the Committee recommends that :

The number of insertions in primary vaccination should be four, two on each arm ; or, if so desired, three on one arm. However, when primary vaccination has to be performed in persons who have passed the age of twelve, it is desirable that the practice of giving *only one insertion* should be continued. For revaccination, however, two insertions should be made as they are considered adequate.

## II. Specific recommendations for instituting smallpox eradication programme

As stated in the preamble, it is possible to eradicate smallpox with the use of the knowledge already available. Many countries in the world have taken steps in this regard. The Eleventh World Health Assembly, in June, 1958, drew attention to the fact that "the funds devoted to the control of, and vaccination against, smallpox, throughout the world, exceed those necessary for the eradication of smallpox in its endemic foci and consequently the destruction of the sources from which the infection arises and spreads", and recommended that "during 1959-60, the population be vaccinated in countries in which principal endemic foci of smallpox exist". The resolution embodying this recommendation was supported by the Indian Delegation.

As has been stated earlier, smallpox had probably reached peak incidence in 1958 and can be reasonably expected to decline to some extent during the ensuing few years before the next severe epidemic overtakes the country. This would probably occur five years hence, as past experience of periodic rise in the

incidence of smallpox would appear to indicate. The Committee, therefore, recommends that :

Steps should be taken to launch with the least possible delay a national small-pox eradication programme in the country, with the avowed object of successfully vaccinating the entire population as far as practicable, and completing the programme within a period of three years. This would necessitate a concerted and simultaneous action in all the States of India.

The Committee further recommends that, in order to attain the aforesaid object, immediate action should be taken on the lines indicated in the subsequent part of this section, to :

- (i) ensure availability of adequate supplies of vaccine lymph,
- (ii) recruit and train adequate numbers of Vaccinators and other personnel required for the campaign,
- (iii) obtain necessary equipment for vaccination work and storage of vaccine lymph at all levels,
- (iv) bring into being a suitable organisation, both at the Centre and in the States, to ensure smooth functioning of the campaign and, above all,
- (v) to prepare the population well in advance to receive the programme as outlined.

The Committee's recommendations, in respect of the various items mentioned above, are as follows :

#### (1) AUGMENTATION OF VACCINE LYMPH SUPPLIES

When a mass campaign for the control and ultimate eradication of smallpox is initiated, it will be necessary to make sure that adequate supplies of lymph will be available throughout the period of the campaign. It appears from the information received from several manufacturing centres that most of them would be able to step up their production of lymph, if additional facilities by way of equipment and personnel are made available to them. The nature of the assistance required by them is given in Appendix II to this report. The Committee, therefore, recommends that :—

- (i) immediate steps should be taken by each of the manufacturing centres to augment its production ;
- (ii) the States, which do not have lymph producing facilities, should take necessary action to set up lymph producing centres ;
- (iii) estimates of lymph requirements should be worked out by each State for itself, taking into account the need to maintain adequate reserves so as to ensure availability of supplies in the event of breakdowns in lymph production.

## (2) USE OF FREEZE-DRIED VACCINE LYMPH

The Committee realised that freeze-dried vaccine, if made available, would facilitate implementation of the mass vaccination programme, particularly in remote and comparatively inaccessible areas. Such a vaccine can withstand, without loss of potency, high temperatures for a longer period than the usual glycerinated vaccine. It is considered capable of retaining its potency for three months when stored at a temperature of 37°C and for two months when stored at a temperature of 45°C. The Committee understood that the Government of India has under consideration the question of establishing of two centres in the country for the manufacture of freeze-dried vaccine. The Committee, however, wished to point out that the control and ultimate eradication of smallpox need not depend on the availability of freeze-dried vaccine. The Committee was of the view that liquid vaccine, which is more easily prepared, can serve the purpose equally well when kept and transported under suitable conditions.

## (3) STORAGE AND DISTRIBUTION OF VACCINE LYMPH

It has already been stated that facilities for storing lymph exist at the manufacturing centres only and there are no arrangements for maintaining adequate stocks of lymph at the peripheral level. The life of vaccine lymph, after issue from the manufacturing centre, is only seven days and it has to be used within that period. This adds to the difficulties of organising a vaccination programme. To facilitate execution of the mass vaccination campaign, it would be essential to hold stocks of lymph under suitable conditions in certain peripheral centres for immediate use in the vicinity. For ensuring storage of adequate quantities of lymph under proper conditions at all levels, the Committee recommends that :

- (i) At each manufacturing centre, lymph should be stored, as stipulated in the Drugs Act, at a temperature below 0°C, but not below -20°C when glass containers are used for storage; the installation of cabinets with -10°C temperature would be both suitable and economical;
- (ii) subsidiary storage depots should be established at district headquarters and at some selected thana headquarters, taking into consideration the size of the districts and the availability or otherwise of suitable communications;
- (iii) at district headquarters, where electricity is available, lymph should be stored in deep-freeze cabinets at temperatures below 0°C;
- (iv) at other centres, the lymph can be stored in ordinary refrigerators operated either by electricity or kerosene oil.

The use of lymph from the subsidiary depots will be governed by the provisions of the Drugs Act of 1940, which lays down the periods during which lymph can be used when stored under different conditions.



#### (4) PROGRAMME SCHEDULE AND RECRUITMENT AND TRAINING OF VACCINATORS

The aim of the mass vaccination programme is to vaccinate *successfully* the entire population of the country within as short a time as possible. It has been suggested that the programme should be completed within a period of three years. It is obvious that about two years will be required to plan and get everything ready for starting the actual vaccinations. Vaccinations will therefore have to be completed within a period of twelve months of the third year. Experience has shown that, in order to eradicate smallpox, it is essential to cover at least 80 per cent of the total population. Taking the population to be about 400 millions during the period of actual vaccination operations, it will be necessary to vaccinate successfully at least 320 million people during the course of twelve months. It is estimated that one Vaccinator can perform, on an average, 100 vaccinations per day with proper recording. On this basis, and taking 260 days as working days in the year, it would be necessary to employ about 20,000 Vaccinators to complete the programme within the stipulated period.

As regards the training of Vaccinators, the Committee makes some specific recommendations. The current practice of training Health Assistants in the diverse techniques of health work has been referred to in the report. It is generally agreed that, for any health programme, it is desirable to arrange multi-purpose training for health personnel of all types. However, for a national campaign of the type envisaged, the training of personnel in vaccination work only is inescapable. The Committee recommends that Vaccinators required for the programme in each district should be recruited from within the district, and given the necessary training at the district headquarters. As was the practice some years ago, it would be enough if those who have studied up to middle Vernacular or middle English or 7th Standard, or those possessing equivalent qualification, are chosen for such training and eventual employment as Vaccinators. The period of training should be one month, during which some essential knowledge of health education techniques should also be imparted. Since the training is to be given at different headquarters centres, a standard programme should be worked out to ensure uniformity of training. The Committee further recommends that the required number of Vaccinators should be recruited one month prior to the inauguration of the campaign, so that, after training, their services can be immediately utilised for the mass vaccination work. The period of service of the Vaccinators should be deemed to have begun from the date they were recruited for training.

#### (5) EQUIPMENT

Equipment required for the mass vaccination campaign should include about 30,000 *Rotary lancets* of a standard design, *Containers* for carrying lymph supplies in the field, *Refrigerators* for storing lymph at subsidiary centres and *Equipment for sterilization* of lancets in the field. In addition, *vehicles* will have to be provided for the transport of Vaccinators, Supervisory staff and lymph supplies from the

centre to the field. It is calculated that at least two vehicles will be required for each district and more if the size of the district is large. Taking the number of districts in India as 350, at least 700 vehicles will be required for this purpose. Some more vehicles will be required for the film units to carry Projectors, Generators, etc. Thus, in all, about 850 vehicles will be required for the mass campaign. The vehicles should be Jeep Station Wagons to afford more seating capacity and protection of equipment and personnel from inclement weather. Bicycles will be needed for use in areas where motor transport cannot be utilised.

#### (6) SOME ESSENTIAL ASPECTS OF THE MASS VACCINATION CAMPAIGN

(a) *Preparation of registers of births and deaths family-wise*—The Committee wished to emphasise the need for preparing family-wise registers of births and deaths for each village to facilitate the work of the Vaccinators and to ensure that the population is vaccinated according to plan. The Panchayat Secretary should be entrusted with the task of preparing the registers which should be well maintained and kept up-to-date, and should be readily available for inspection. In the initial stages, additional staff will have to be given to the Panchayat Secretary for this purpose. The Committee wished to draw special attention in this connection to the practice adopted in Madras State several years ago. There, the register is maintained family-wise, showing the state of vaccination of each member of the household. Such a register facilitates the work of the Vaccinators, helps to avoid indiscriminate revaccinations, and makes the protection of vulnerable groups easy of accomplishment.

(b) *Vaccination programme*—The vaccination programme should be so arranged that all the inhabitants of one village are protected in one day. The required number of Vaccinators should be made available according to the size of the population of the village and posted for duty according to a pre-arranged plan. It must be remembered that some vaccinations may have to be done by house-to-house visits, because some people are likely to avoid assembling at a central place in the village for the purpose.

(c) *Records of vaccinations*—The success of the vaccination programme will depend on correct recording of the results of vaccination. The record form in use in Madras State is considered comprehensive enough for the purpose (Appendix V). For checking and recording of results, sufficient supervisory staff is essential. The Committee recommends that, while the newly recruited Vaccinators will do vaccination work, the existing trained vaccinating staff of each State should be entrusted with the task of supervising and recording results of vaccinations.

#### (7) HEALTH EDUCATION

The question of health education was considered in great detail. It was felt that, unless the population is made fully alive to what is being attempted, *and why*,

the whole eradication programme would be greatly handicapped. Reference might be made in this connection to some of the results obtained from preliminary surveys conducted in two areas, the Najafgarh Health Unit area near Delhi and the Poonamallee Health Unit area near Madras, where attempts were made to find out the people's attitude to vaccination and their response to vaccination programmes envisaged by the health authorities. Many wrong beliefs, some of them inspired by protagonists of vaccination who are carried away with their own enthusiasm or are suffering from lack of knowledge, are held regarding the causation and prevention of smallpox and the efficacy of vaccination. These should be taken note of and suitably countered. Otherwise they might easily hinder implementation of the vaccination programme. Belief that vaccination prevents other diseases as well should not be fostered, as that approach may initially help in the vaccination programme but would soon be followed by disillusionment. Also, creating the belief that one vaccination gives permanent protection against smallpox leads to loss of faith in vaccination when smallpox strikes a person some years after that vaccination. The studies at Najafgarh and Poonamallee have also brought to light the fact that it is mostly women who determine whether or not the children will be vaccinated. Opposition to vaccination programmes is encountered not only from the ignorant and the illiterate, but also sometimes from the educated people, some of them holding responsible positions. In one area, 75 per cent of the people either did not know how smallpox is prevented or believed that it could not be prevented at all. There is, however, an encouraging finding of these studies and that is that, with proper approach, people can be educated to appreciate the value of vaccination. The experience of health authorities is generally in accord with the above findings.

It was the general view that, while the methodology of the mass campaign against smallpox is being worked out, opportunities should be taken to impart health education on a broad basis without loss of time, taking into consideration the attitudes of the people mentioned in the preceding paragraph. The utilisation of diverse means, such as, films, film strips, advertisements, the press, the radio, 'bhajjan' parties, public meetings and exhibitions, was considered appropriate in order to instil in the minds of the people the necessity of co-operating wholeheartedly in the eradication programme. Production of health education films, it was urged, should receive top priority in the programme of the Films Division of the Government of India.

In respect of films, some very useful suggestions were made. Important amongst those were that the films should be not only educative but also entertaining; that emphasis in them should be on DOs and not on DONTs; that they should be in the local language; that there should be a properly planned sequence in the story depicted; that special attention should be paid while producing the film to see that the religious sentiments of the people are not ridiculed in any way; that no attempt should be made to show awe-inspiring or panic-creating scenes;

that they should be such as to impress the women and children. It was felt that it is necessary to fully indoctrinate women in the principles of health education in order to enthuse them, and, through them, the male adult population, with the value of imbibing that useful knowledge.

It was considered advisable that the health education programme should be planned in consultation with some expert advertising agency or publicity organisation and that the films and slides should be shown daily in cinema houses along with the day's scheduled picture and documentary film.

It was suggested that the films should not be shown in isolation, but that they should be preceded and followed by light entertaining films. Such a procedure was considered likely to help the audiences to sustain interest in the health educative film.

The Committee accordingly recommends that :

Preparations for health education, as indicated above, should be taken in hand as soon as the principle of the eradication programme is accepted and education of the population carried out with increasing tempo so that the people are fully ready to receive the programme when it is launched.

#### (8) FORMATION OF ANTI-EPIDEMIC COMMITTEES\* AT DISTRICT LEVEL

The Committee was informed that, at the annual Conference on Community Development at Mount Abu in April, 1958, a unanimous decision was taken to recommend the establishment of District anti-epidemic Committees in each State to help the authorities in the control of smallpox. The Conference was of the opinion that such Committees should consist of the District Health Officer, representatives of the Education and Development Departments of the State, members of the Assembly and the Council, and representatives of women's and other voluntary organisations.

The objectives of such Committees would be to secure the willing co-operation of the people through their representatives in the implementation of control measures against smallpox. Important among these would be the efficient organisation vaccination against smallpox. Field workers of the Community Development Programme are specially trained in the methodology of approach to the people to secure their willing co-operation in endeavours for the common good, and it will be advantageous to utilise the experience gained in this regard in the fulfilment of the objectives mentioned above.

The District anti-epidemic Committees should work in close co-operation with the Epidemiological Unit recommended to be established at the State level at (10).

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\*These Committees are to help in the control of cholera also.

The Committee wholeheartedly supports the idea of the formation of District anti-epidemic Committees and considers it an essential part in the overall drive against smallpox.

#### (9) PILOT PROJECTS

In order to estimate the approximate requirements of the eradication programme in respect of manpower and finances, the Committee recommends that each State should institute a pilot project for this purpose. In the opinion of the Committee, it would be helpful if one district, or C.D. Block with a total population of about 66,000, is chosen for the pilot project. The estimated requirements in respect of equipment, including transport, should be ascertained. Expenditure likely to be incurred on the preparation of registers should also be estimated. The pilot projects would help in working out costs involved in different States for the smallpox eradication programme. The Committee realised that some States may be having some information in this regard already. Mysore is one such. The data collected from a mass campaign conducted in a limited area of Mysore State are given in Appendix IV.

#### (10) EPIDEMIOLOGICAL UNITS\*

During the course of the smallpox eradication programme, and even after its termination, it is probable that some cases of smallpox will be reported from the areas covered by the campaign. The Committee considers it desirable that attempts should be made to study the probable source of infection in these cases. Such a vigilance is essential, since it will bring to light shortcomings, if any, in the organisation of the campaign, and provide opportunities to remedy them. That will ensure the ultimate success of the campaign. The Committee, therefore, recommends that :

An epidemiological unit should be established in each State for a continuous study of the problem of smallpox. It would be desirable to entrust the epidemiological unit with the task of gathering and disseminating information in respect of that disease.

#### (11) ORGANISATION OF THE VACCINATION CAMPAIGN

The Committee considered this matter in detail and, in this connection, took note of the statements in this regard contained in W.H.O. document EB 23/43 of 16th December, 1958 which say that "no campaign can possibly succeed unless two qualities of ability and enthusiasm are equally present in the directing and supervisory staff" and that "a clear line of command must exist from *vaccinator* in the field to *director* in the highest place in medical headquarters, who is responsible

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\*These units would deal with cholera also.

for information, finance, stores, transport, staff welfare and every other administrative factor".

In order to ensure the success of the campaign as envisaged in the report, the Committee is of the opinion that a suitable administrative machinery should be created at the District and State level, as well as in the Central Ministry of Health, with adequate powers to deal effectively with the day-to-day administrative problems and take decisions on any matter concerning the campaign. The Committee's recommendations in this regard are :

(a) *Organisation at the district level*—All the Vaccinators in a district should work under the overall supervision of a Medical Officer with experience in the conduct of a mass campaign. He should be assisted by Health Assistants or Sanitary Inspectors, who should be mainly responsible for the checking of results of vaccination. The Medical Officer should have sufficient disciplinary powers to deal with day-to-day problems that may arise during the course of the campaign. The total staff at the district level should be as follows :—

Organising Medical Officer	...	1
Vaccinators, at the rate of one per 20,000 of the population.	... Calculated number	
Health Assistants, at the rate of one per five Vaccinators	... Calculated number	
Publicity Assistant	...	1
Drivers	...	2
Clerks	...	2
Peons, Cleaners, Messengers	...	5

(b) *Organisation at the State level*—A full time officer of the status of an Assistant Director of Public Health should be in overall charge of the programme at State Headquarters, with sufficient financial and disciplinary powers. He should be responsible for the procurement, storage and distribution of vaccine lymph. It should also be his responsibility to maintain the transport required for the purpose in a roadworthy condition, and, for this, he should be given authority to entrust the work of maintenance of vehicles to private agencies, if it is necessary to do so. He should be in overall charge of the Epidemiological Units mentioned earlier, as well as of personnel in charge of health education.

The staff at State level should consist of :

A full time Assistant Director of Public Health	...	1
Publicity Officer	...	1
Statistical Officer	...	1
Mechanics	...	2

Clerks	...	5
Driver	...	1
Peons	...	3
Cinema operators, at the rate of one unit for three districts.	...	Calculated number

(c) *Organisation at the Central Ministry of Health*—This organisation should be designated Central Smallpox and Cholera Control Commission. Its composition, functions, and utility should be as follows :

*Central Smallpox and Cholera Control Commission\**—In the implementation of the recommended programme for the control and eradication of smallpox and cholera, there would be the need to establish a suitable machinery for co-ordinating the various activities in this connection in the participating States. The Committee, therefore, recommends that the Government of India should constitute a Central Smallpox and Cholera Control Commission, consisting of full-time members. The task of the Commission should be :

- (a) to ensure that the approved programme is carried out according to plan and to administer the funds placed at its disposal ;
- (b) to act as a central advisory board for the execution of the programme ;
- (c) to co-ordinate the activities of the States ;
- (d) to assess periodically the progress made ;
- (e) to serve as a clearing house of information, including that obtained by the different epidemiological units, for the Union and the State Ministries of Health ; and
- (f) to undertake all such other tasks that may require to be performed in the interest of the eradication programme.

The Commission should consist of :

- (1) Five medical members.
- (2) One statistician.
- (3) One public health engineer.
- (4) One financial adviser.
- (5) Ancillary staff, which will include publicity officer, sectional assistant, statistical assistants, stenographers, clerks, etc.

Out of the five medical members, one should be the Chairman, one Member-Secretary and the remaining three to serve as zonal representatives of the Commission. All of them should be conversant with the problems involved in the

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\*As this Commission will function in respect of smallpox as well as cholera, both the diseases are included in its name and its composition is so arranged that it can deal with both the diseases.

control and eradication of the two diseases and one of them should preferably be an epidemiologist.

The public health engineer would render advice and guidance in respect of environmental sanitation programmes in the control of cholera.

The three medical members to serve as zonal representatives should have adequate experience in public health administration to be able to co-ordinate the work of the States comprising their respective zones.

The composition of the zones should be as under :

One zone should include West Bengal, Bihar, Uttar Pradesh, Punjab and Assam.

The second zone should include Orissa, Madhya Pradesh, Rajasthan and Bombay.

The third zone should include Andhra Pradesh, Mysore, Madras and Kerala.

The zonal grouping is based on the characteristic epidemiological features of cholera in the territories so grouped and would be suitable from the points of view of accessibility and administrative convenience for the zonal representatives to function effectively. The zonal representatives would co-operate actively with the senior officer of the State health department nominated to be in full-time charge of the eradication operations in the State.

#### (12) ESTIMATE OF COST OF SMALLPOX ERADICATION PROGRAMME

The Committee has attempted to work out the cost of Smallpox Eradication Programme on a broad basis. In doing so, it has not taken into account the allocation of funds between the Central Government and the States, nor has it taken into account the expenditure which is already being incurred by the States in their routine vaccination programmes. In the discussion of this subject a view emerged that it may be necessary for the Central Government to provide the expenditure over and above that normally incurred by States Governments on measures for the control of Smallpox.

For the sake of convenience, the estimated cost relating to the salaries of staff, both at the Central and State level, has been shown in one consolidated figure and the total expenditure on equipment and contingencies required by the Centre and the States is also similarly shown. It has to be noted that the cost of one dose of vaccine lymph ranges between one anna and two annas in different States. However, a round figure of two annas per dose has been adopted. The provision made for additional lymph supplies includes the expenditure involved in providing equipment and additional staff to the existing manufacturing centres for increasing their production. The details of the estimates are as follows :—



## BUDGET FOR ONE YEAR.

	<i>Rupees in millions</i>
(a) <i>Pay and Allowances</i>	
Pay of 20,000 Vaccinators @ a consolidated monthly rate of Rs. 130 per head.	31.20
Pay of 350 Organising and Supervising Medical Officers @ a consolidated pay of Rs. 500 p.m.	2.10
Pay of ancillary staff including Publicity Assistants.	4.47
Pay and Allowances of 14 Assistant Directors of Public Health.	0.17
Pay and Allowances of other staff at State H.Q.	0.37
Pay and Allowances of 4 Regional Officers and their staff.	0.10
Pay and Allowances of those of the Central Immunization Organisation.	0.40
Pay and Allowances of remaining drivers and 100 Cinema Operators.	0.37
Total pay and allowances ...	39.18
(b) <i>Vehicles</i>	
Cost of 850 Jeeps @ Rs. 15,500 each, with Public Address Equipment.	13.18
Cost of running 850 Jeeps, including cost of petrol, maintenance, etc.	4.76
Cost of 5,000 cycles at Rs. 200 per cycle.	1.00
Total cost of vehicles ...	18.94
(c) <i>Equipment</i>	
Cost of 100 Cinema equipment units @ Rs. 5,000 each.	0.50
Cost of 22,000 vaccination kits, including sterilisers, etc., @ Rs. 80 each.	1.80
Cost of 720 Refrigerators at the rate of 2 per district and 1 each for States @ Rs. 1,500 each and the cost of card-board box-refrigerator-containers.	1.06
Total cost of equipment ...	3.36
(d) <i>Films Pamphlets, Posters, etc.</i>	1.00
(e) <i>Cost of 100 million doses of additional vaccine @ 2 annas per dose</i>	12.50
(f) <i>Contingencies, including printing of registers, etc.</i>	0.27
Grand total ...	75.25

## (13) TIME-TABLE OF THE ERADICATION PROGRAMME

The Committee recommends that the entire smallpox eradication programme should be completed within a period of three years from the date of its inception. The programme will have to be carried out in two phases, the first phase being devoted primarily to planning, obtaining the necessary equipment, etc. and the second phase to the actual work of vaccination. The Committee recommends the following orders of priority in the implementation of the programme :

*First phase—period of planning*

- A. 1. Enactment of laws, making primary vaccination and revaccination compulsory.
2. Promulgation of the Epidemic Control Act on the lines recommended by the Committee.
- B. 1. Appointment of a Central Control Commission.
2. Appointments by States of their planning officers, i.e., Assistant Directors of Public Health in full charge of operations at State level.
3. Provision of additional facilities to augment vaccine lymph supplies.
4. Institution of Pilot Projects by States.
5. Working out the details of the eradication programme.
6. Working out the details for the distribution of vaccine lymph according to a plan.
7. Printing of special registers for registration of births and deaths and also for recording particulars of people vaccinated.
8. Preparation of material for health education, viz., films, pamphlets, etc., and, when ready, starting of a health education campaign which should gather increasing momentum and reach its highest pitch just at the time when the mass vaccination programme is launched.
9. Procurement of equipment, such as, lancets, sterilising sets, transport vehicles, refrigerators, etc.
10. Recruitment of Vaccinators in time to give them one month's training prior to the inauguration of the actual vaccination work.

*Second phase*

Execution of mass vaccination campaign according to plan.

It is to be noted that action on many of the items listed under the first phase can be initiated simultaneously.

## VIII. ABSTRACT OF RECOMMENDATIONS

### (1) REGISTRATION OF BIRTHS AND DEATHS

In view of the multiplicity of practices in regard to registration of births and deaths leading to unsatisfactory results and with the object of improving the situation, the Committee recommends :—

- (a) That there should be an Act making registration of vital events compulsory and that that Act should legislate for the provision of proper facilities for registration, setting up of registering offices easily accessible to those reporting vital events, and awarding of punishment for lapses in the duties of reporting or recording of vital events ;
- (b) that the Secretary of Gram Panchayat should be appointed Registrar of births and deaths for his area ;
- (c) that the Secretary of Gram Panchayat should send figures of vital statistics to the Block office from where such information could be forwarded to the Sub-division or District office ;
- (d) that arrangements should be made for the peripheral reporting officials to send information about births and deaths by post on unstamped cards, the postage charges being recoverable by the postal authorities later on in consolidated amount in a manner similar to the one adopted in respect of commercial concerns ; or perhaps, the Committee felt, the Centre could give exemption from affixing of postage stamps on communications notifying births and deaths ;
- (e) that the registers containing records of vital events should be preserved ;
- (f) that the officers of the health administration should have the right to inspect these registers ;
- (g) that before a child is admitted to a primary school, even in the villages, the parents should be required to produce a certificate of his/her birth. Such a practice, the Committee felt, would compel the parents to have the births of their children registered ;
- (h) that the power to prosecute for lapses in reporting or registration of vital events should be vested in the District Health Officers instead of the Tehsildars.

### (2) LEGAL PROVISIONS

- (a) A Central Infectious Diseases Control Act should be promulgated, more or less on the lines of the Central Food Adulteration Act, to ensure uniform procedures all over the country in respect of control of smallpox ;
- (b) one authority in each State should be entrusted with the task of enforcement of legal provisions in respect of vaccination ; and
- (c) both primary vaccination and revaccination should be made compulsory.

## (3) EARLY DETECTION AND NOTIFICATION OF CASES

In view of the importance of early recognition of cases, and taking into account the several views expressed in this regard, the Committee recommends that :—

- (a) it would be better to place the responsibility of notification on the Panchayats because the Chowkidar or the Gram Sevak or the Village Headman will presumably be under the control of the Panchayat ;
- (b) the Panchayat Secretary should transmit the information to health authorities by telegram, where a telegraph office exists, otherwise by a special messenger, and the doctor in charge the Primary Health Centre or the Sanitary Inspectors and the District Medical Officer of Health should be informed by him simultaneously ; and
- (c) for the guidance of Chowkidars and others, special instructions should be prepared to help them to recognise cases and impress on them the necessity of reporting them without delay.

## (4) PURITY AND POTENCY OF VACCINE LYMPH

- (a) *Purity*—The Committee recommends that, while vaccine lymph has to conform to the specifications laid down in the Drugs Act of 1940, suitable laboratory procedures should be adopted for the elimination of pathogenic staphylococci from lymph.
- (b) *Potency*—To secure uniformity in the potency of lymph and to know whether issued lymph, during the period between its despatch and use, has not lost its potency, the Committee recommends that :—
  - (i) batches of lymph manufactured by different laboratories should be tested at a central place designated for the purpose as a reference laboratory, and
  - (ii) arrangements should be made to return random samples of the lymph issued for use in the field to the issuing laboratory for re-testing.

By adopting the procedures mentioned at (i) and (ii) above, it would become possible to take appropriate measures to remedy defects when noticed.

## (5) UTILISATION OF LYMPH IN THE FIELD

- (a) *Age when primary vaccination can be given*—The Committee, while recommending that the practice of giving primary vaccination within the age period 4 to 6 months should be continued, saw no scientific reason why vaccination should not be performed even at an earlier age, should that become necessary because of the presence of smallpox in the area.
- (b) *Interval between primary vaccination and revaccination*—In view of the fact that immunity conferred by primary vaccination gradually diminishes, it is necessary to boost it up by periodic revaccinations. The first

revaccination should be done at the age of 5 and subsequent ones should be given every five years till age 15 is reached. To facilitate fulfilment of this recommendation, arrangements should be made to vaccinate all children at the time of entry to school, again at age 10 and then at the time of leaving school. The question of giving revaccination after the age of 15 will require to be considered in the light of the results obtained from the proposed programme.

- (c) *Technique of vaccination*—As regards the technique of vaccination, the Committee recommends that, while the multiple pressure method would normally be the method of choice, the rotary lancet technique should continue to be employed in the mass vaccination campaign because of its simplicity and the familiarity of the Vaccinators with its use.
- (d) *Number of insertions*—The Committee recommends that the number of insertions in primary vaccination should be four, two on each arm, or, if so desired, three on one arm. In case of primary vaccination in persons who have passed the age of 12, only one insertion should be given.

#### (6) SMALLPOX ERADICATION PROGRAMME

The Committee recommends that steps should be taken to launch with the least possible delay a national smallpox eradication programme, with the avowed object of successfully vaccinating the entire population as far as practicable, and completing the programme within a period of three years. This would necessitate a concerted and simultaneous action in all the States of India.

The Committee further recommends that, in order to attain the aforesaid object, immediate action should be taken on the lines indicated in the subsequent part of this section, to :

- (a) ensure availability of adequate supplies of vaccine lymph,
- (b) recruit and train adequate numbers of Vaccinators and other personnel required for the campaign,
- (c) obtain necessary equipment for vaccination work and storage of vaccine lymph at all levels,
- (d) bring into being a suitable organisation, both at the Centre and in the States, to ensure smooth functioning of the campaign, and, above all,
- (e) prepare the population well in advance to receive the programme as outlined.

#### (7) AUGMENTATION OF VACCINE LYMPH SUPPLIES

The Committee recommends that :—

- (a) Immediate steps should be taken by each of the manufacturing centres to augment its lymph production ;

- (b) the States which do not have lymph producing facilities, should take necessary action to set up lymph producing centres ; and
- (c) estimates of lymph requirements should be worked out by each State for itself, taking into account the need to maintain adequate reserves so as to ensure continued availability of supplies in the event of breakdowns in lymph production.

#### (8) USE OF FREEZE-DRIED VACCINE

The Committee realised that freeze-dried vaccine, if made available, would facilitate the implementation of mass vaccination programme. However, the Committee wished to point out that the control and ultimate eradication of Small-pox need not depend on the availability of freeze-dried vaccine and that liquid vaccine, which is more easily prepared, can serve the purpose equally well when kept and transported under suitable conditions.

#### (9) STORAGE AND DISTRIBUTION OF VACCINE LYMPH

The Committee recommends that subsidiary storage depots should be established at district headquarters and at some selected thana headquarters, taking into consideration the size of the districts and the availability or otherwise of suitable communications.

#### (10) RECRUITMENT AND TRAINING OF VACCINATORS

The Committee recommends that :—

- (i) About 20,000 Vaccinators should be recruited to complete the programme within the stipulated period ;
- (ii) the Vaccinators should be recruited from within the district and given the necessary training at district headquarters ;
- (iii) it should be accepted as sufficient if those who have studied upto middle vernacular or 7th standard are chosen for such training ;
- (iv) the period of training should be one month during which some essential knowledge of health education techniques should also be imparted.

The Committee further recommends that the required number of Vaccinators should be recruited one month prior to the inauguration of the campaign, so that, after training, their services can be immediately utilised for the mass vaccination work. The period of service of the Vaccinator should be deemed to have begun from the date they were recruited for training.

#### (11) EQUIPMENT

The Committee recommends that steps should be taken well in advance for securing the necessary vehicles for the use of the field staff as well as refrigerators, projectors, generators, etc.

(12) SOME IMPORTANT POINTS TO BE ATTENDED TO FOR THE SUCCESS OF THE MASS  
VACCINATION CAMPAIGN

- (i) The Committee recommends the preparation, well in advance, of family-wise birth and death registers to be maintained for each village, drawing up of a vaccination programme to ensure ready supplies of lymph so as to facilitate uninterrupted work of the Vaccinators, and making of arrangements for recording the results of vaccinations.
- (ii) The Committee further recommends that, while the newly recruited Vaccinators should do vaccination work, the existing trained vaccinating staff of each State should be entrusted with the task of supervising the Vaccinators' work and recording results of vaccination.

(13) HEALTH EDUCATION

The Committee recommends that preparations for health education of the people should be taken in hand as soon as the principle of the eradication programme is accepted, and education of the population should be carried out with increasing tempo so that the people are fully ready to receive the programme when it is launched.

(14) FORMATION OF ANTI-EPIDEMIC COMMITTEES AT THE DISTRICT LEVEL

The Committee whole-heartedly supports the idea of formation of District Anti-epidemic Committees.

(15) PILOT PROJECTS

The Committee recommends that, in order to estimate the requirements of the eradication programme in respect of manpower and finances, each State should institute a pilot project for this purpose in an area with a total population of not less than 60,000.

(16) EPIDEMIOLOGICAL UNITS

The Committee recommends the formation of Epidemiological Units in each State for the continuous study of the smallpox problem.

(17) ORGANISATION OF THE VACCINATION CAMPAIGN

In order to ensure the success of the campaign as envisaged, the Committee recommends that a suitable administrative machinery should be created at the District and State level, as well as in the Central Ministry of Health, with adequate powers to deal effectively with the day-to-day administrative problems and take decisions on any matter concerning the campaign.

## (18) CENTRAL ORGANISATION

The Committee recommends that the Central organisation should be named the Central Smallpox and Cholera Control Commission.

## (19) ESTIMATE OF COST OF SMALLPOX ERADICATION PROGRAMME

The Committee recommends a total provision of Rs. 7.5 crores for the smallpox eradication campaign. In arriving at this estimate the Committee has not taken into account the expenditure incurred by each State on its routine vaccination programmes.

## (20) TIME-TABLE OF THE ERADICATION PROGRAMME

The Committee recommends that the entire programme should be completed in three years and should be carried out in two phases, the first phase relating to the period of planning and the second phase to the actual execution of the campaign. Priorities of procedures are indicated.





## APPENDIX I

### Incidence of Smallpox in India

Statement showing :— (i) Smallpox attacks and deaths in States during the period 1948-58, and  
(ii) total number of smallpox vaccinations performed each year during that period.

#### ANDHRA PRADESH

\*Population : 3,12,60,133 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1948	2,046	380	N.A.	N.A.	N.A.
1949	11,891	2,357	N.A.	N.A.	N.A.
1950	22,609	4,600	N.A.	N.A.	N.A.
1951	34,470	7,254	N.A.	N.A.	N.A.
1952	11,682	2,180	N.A.	N.A.	N.A.
1953	3,939	735	7,31,498	16,34,008	23,65,506
1954	3,191	716	5,79,295	18,02,267	23,81,562
1955	4,368	849	4,29,696	10,73,884	15,03,580
1956	7,100	1,492	5,60,900	21,99,623	27,60,523
1957	19,984	4,223	13,31,381	45,59,096	58,90,477
1958	15,679	3,879	11,66,525	33,50,009	45,16,534

#### ASSAM

Population : 90,43,707 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1948	N.A.	334	N.A.	N.A.	N.A.
1949	N.A.	117	N.A.	N.A.	N.A.
1950	N.A.	110	N.A.	N.A.	N.A.
1951	N.A.	896	N.A.	N.A.	N.A.
1952	N.A.	531	N.A.	N.A.	N.A.
1953	N.A.	237	N.A.	N.A.	N.A.
1954	52	9	N.A.	N.A.	N.A.
1955	10	Nil	N.A.	N.A.	10,41,586
1956	197	66	N.A.	N.A.	8,51,043
1957	539	136	N.A.	N.A.	9,34,435

N.A. = Not available.

\*Since the re-organisation of States, population figures would be markedly different in the re-organised States.

**BIHAR**

Population : 4,02,25,947 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1949	N.A.	3,206	9,96,090	11,14,611	21,10,701
1950	N.A.	9,555	N.A.	N.A.	N.A.
1951	N.A.	41,995	7,71,580	51,74,766	59,46,346
1952	6,496	896	5,88,883	62,82,280	68,71,163
1953	2,341	292	7,51,214	29,17,789	36,68,403
1954	2,281	632	10,47,057	54,29,779	64,76,836
1955	2,181	502	11,85,154	1,45,41,730	1,57,26,884
1956	2,712	789	14,88,256	1,22,92,814	1,37,81,070
1957	3,124	847	11,56,604	92,13,201	1,03,69,805
1958	9,956	2,781	13,61,810	1,27,54,526	1,41,26,336

(Upto 25-10-1958)

**BOMBAY**

Population : 4,82,66,220 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1947	7,594	2,161	6,67,701	9,60,844	16,28,545
1948	9,456	3,239	7,02,899	15,27,990	22,30,889
1949	21,860	6,768	10,23,691	32,60,084	42,83,775
1950	22,877	9,034	10,49,416	20,06,132	30,55,548
1951	18,658	6,102	12,02,464	22,19,081	34,21,545
1952	10,477	3,731	12,61,649	22,33,897	34,95,546
1953	7,921	2,112	12,62,545	21,51,480	34,14,025
1954	12,416	3,048	13,39,657	52,93,715	66,33,372
1955	8,209	2,419	13,20,114	52,94,680	66,14,794
*1956	N.A.	4,644	9,84,744	42,31,650	52,16,394
*1957	25,897	10,191	19,28,197	54,36,551	73,64,748

**KERALA**

Population : 1,35,51,529 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1950-51	998	339	43,874	2,03,818	2,47,692
1951-52	1,134	514	46,828	2,35,942	2,82,770
1952-53	1,174	448	5,66,047	13,72,814	19,38,861
1953-54	1,478	522	5,38,612	13,65,958	19,04,570
1954-55	1,663	695	6,42,768	19,80,956	26,23,724
1955-56	114	31	5,34,472	13,51,469	18,85,941
1956-57	1,033	387	6,40,126	21,04,626	27,44,752
1957-58	1,601	601	7,01,508	28,66,924	35,68,432

N.A.=Not available.

\*Figures for re-organized Bombay State.

**MADRAS**

Population : 5,70,16,002 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1948	1,342	259	8,12,748	14,10,810	22,23,558
1949	4,585	5,630	8,85,345	24,68,870	33,54,215
1950	24,003	5,630	9,32,926	47,40,364	56,73,290
1951	32,476	8,618	11,54,457	59,45,202	70,99,659
1952	7,045	1,722	9,72,429	32,15,742	41,88,171
1953	2,737	621	9,52,512	27,26,377	36,78,889
1954	7,596	912	10,00,503	31,77,539	41,78,042
1955	1,242	292	9,21,654	24,21,690	33,43,344
1956	3,454	1,086	10,63,461	31,33,302	41,96,763
1957	12,512	3,427	11,33,142	55,90,239	67,23,381
1958	13,852	4,230	11,79,871	57,05,180	68,85,051

**MYSORE**

Population : 1,94,01,477 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1948	1,396	239	1,62,074	2,07,747	3,69,821
1949	3,198	651	2,14,165	7,19,966	9,34,131
1950	2,689	589	1,90,024	4,98,553	6,88,577
1951	3,503	715	3,16,561	7,98,756	11,15,317
1952	1,995	522	2,77,243	7,15,317	9,92,560
1953	1,597	259	1,89,206	7,27,058	9,16,264
1954	1,085	288	2,31,098	5,47,872	7,78,970
1955	642	102	3,26,220	10,10,126	13,36,346
1956	589	106	4,44,079	8,09,196	12,53,275
1957	3,465	1,033	7,37,831	22,90,296	30,27,927
1958	5,601	1,460	(Figures under compilation)		

(From Jan. '58 to end of Sep. '58)

**ORISSA**

Population : 1,46,00,000 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1949	3,063	458	3,92,254	12,88,029	16,80,283
1950	13,128	2,313	4,50,389	17,16,323	21,66,712
1951	19,878	4,108	5,04,303	23,04,978	28,09,281
1952	12,192	2,177	4,50,554	11,17,623	15,68,177
1953	3,796	519	4,93,219	9,45,729	14,38,939
1954	3,212	374	5,31,024	9,82,292	15,13,316
1955	2,113	198	5,10,650	8,17,975	13,28,625
1956	1,645	108	5,72,133	9,82,060	15,54,193
1957	12,331	3,156	5,64,415	16,13,494	21,77,909
1958	28,799	7,443	3,04,576	12,90,458	15,95,034

(Upto 1-11-58)

**PUNJAB**

Population : 1,61,34,890 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1948	8,368	2,225	N.A.	N.A.	26,53,727
1949	3,292	880	N.A.	N.A.	22,11,849
1950	10,564	1,143	N.A.	N.A.	22,00,583
1951	2,879	602	N.A.	N.A.	19,58,192
1952	3,598	609	N.A.	N.A.	23,08,812
1953	6,192	1,524	N.A.	N.A.	31,75,807
1954	2,495	444	N.A.	N.A.	23,83,248
1955	1,652	290	N.A.	N.A.	26,50,041
1956	787	187	N.A.	N.A.	26,46,149
1957	1,192	199	N.A.	N.A.	30,58,286

**RAJASTHAN**

Population : 1,59,70,774 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1950	7,976	2,635	3,92,719	2,76,930	6,69,649
1951	2,780	807	4,07,879	2,40,760	6,48,639
1952	3,147	872	4,39,042	2,74,547	7,13,589
1953	2,745	897	4,84,182	3,09,767	7,93,949
1954	3,625	1,229	4,19,111	3,13,912	7,33,023
1955	4,625	2,038	4,77,103	3,39,704	8,16,809
1956	4,071	1,435	5,51,458	3,94,014	9,45,472
1957	4,801	1,471	5,26,813	5,90,067	11,16,880
1958 (Provisional)	5,353	1,240	69,519	1,59,716	2,29,235

**UTTAR PRADESH**

Population : 6,32,00,000 (1951 Census)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1948	N.A.	9,629	13,37,882	9,41,645	22,79,527
1949	N.A.	8,236	13,47,317	11,67,921	25,15,238
1950	N.A.	27,148	14,35,738	17,69,595	32,05,333
1951	N.A.	49,195	15,35,973	15,03,692	30,39,665
1952	N.A.	18,495	15,59,053	13,07,780	28,66,833
1953	N.A.	13,625	15,54,157	14,90,520	30,44,677
1954	N.A.	16,405	16,58,063	18,57,487	35,15,550
1955	N.A.	15,262	17,43,437	25,65,949	43,09,386
1956	N.A.	5,742	17,80,407	20,57,227	28,37,634
1957	N.A.	7,103	19,00,589	21,02,245	40,02,834

N.A. = Not available.

## WEST BENGAL

Population : 2,84,88,196 (1957)

Year	Attacks	Deaths	Primary vaccinations	Revaccinations	Total vaccinations
1948	14,492	7,909	8,00,336	55,92,893	63,93,229
1949	2,737	1,244	6,64,352	48,32,370	54,96,722
1950	22,789	12,268	8,13,482	63,12,480	71,25,962
1951	51,628	26,888	11,73,856	82,93,867	94,67,723
1952	9,243	3,574	8,29,291	67,02,899	75,32,190
1953	1,088	513	9,00,948	64,63,216	73,64,164
1954	2,300	850	10,98,859	75,54,064	86,52,923
1955	1,126	1,502	10,57,964	67,48,891	78,06,855
*1956	2,746	1,185	11,09,128	77,94,701	89,03,829
*1957	18,612	10,095	16,09,930	1,10,94,204	1,27,04,134
*1958 (Up to 31st October)	27,261	11,141	13,48,265	90,69,227	1,04,17,492

\*Provisional.



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## APPENDIX II.

### Synopsis of Replies Received from States Regarding the Output of Vaccine Lymph.

Serial No.	Name of the State	Current vaccine lymph production (in doses)	Whether the output of vaccine lymph can be stepped up and, if so, to what extent.
1.	Andhra Pradesh. Institute of Preventive Medicine, Hyderabad.	1955— 17,44,800 1956— 14,60,900 1957— 17,24,360 1958— 33,02,260	<p>Production of vaccine lymph can be stepped up to a maximum of 180 lakh doses. Proposal for the construction of an additional maturing shed and installation of one more operation table is with the State Government.</p> <p>When the additional facilities are made available, and extra staff as proposed is sanctioned, it would be possible to manufacture a maximum of hundred lakh doses, i.e. ten million doses per year, provided calves are available. Cost of extra staff required would be approximately Rs. 25,000 per year.</p> <p>Vaccine lymph requirement of the State of Andhra Pradesh, including Telengana, is expected to be about thirty lakh doses. The balance of about seventy lakh doses could be supplied to other States and included in the general pool.</p>
2.	Assam. State Vaccine Department, Shillong.	1956— 24,92,475 1957— 29,81,855 1958— 34,56,775	<p>Difficulty is experienced in getting calves and this will stand in the way of stepping up lymph output.</p>
3.	Bihar. Vaccine Department, Namkum.	1956— 1,21,42,230 1957— 1,31,05,944 1958— 1,77,68,731	<p>Production of vaccine lymph can be stepped up to 2 crore doses, provided requisite facilities are available. Total additional cost is estimated to be Rs. 28,000.</p>
4.	Bombay. Vaccine Institute, Nagpur.	1956— 37,58,620	<p>Without additional accommodation and staff, it will not be possible to step up the output of lymph further, and a proposal to achieve increased production is already before the Government. Estimated expenditure involved is Rs. 4,22,000. If it is approved, the output can go up to 1,36,00,000 doses.</p>

Serial No.	Name of the State	Current vaccine lymph production (in doses)	Whether the output of vaccine lymph can be stepped up and, if so, to what extent.
5.	Kerala. Public Health Laboratory, Trivandrum.	1956— 33,45,870 1957— 42,72,970 1958— 51,65,842	—
6.	Madras. King Institute, Guindy.	Output per annum ranges between three to six million doses.	—
7.	Madhya Pradesh. Manpur Lymph Depot.	62 lbs., 10 ozs., 2 dr and 10 M of vaccine lymph were manufactured during 1957-58.	—
8.	Mysore. Vaccine Institutes, Belgaum and Bangalore.	1955— 32,00,000 1956— 50,11,365 1957— 1,45,57,145	The output of vaccine lymph can be stepped up, provided additional funds and staff are available.
9.	Punjab. Vaccine Institute, Amritsar.	1956— 27,66,000 1957— 26,46,375 1958— 30,46,375	Subject to the availability of additional funds and staff, the output of vaccine lymph can be doubled at an estimated extra cost of Rs. 45,000 for cold room and equipment.
10.	Uttar Pradesh. State Vaccine Institute, Patwadangar, Naini Tal.	1956— 1,13,00,000 1957— 1,03,00,000 1958— 1,57,00,000	The output of vaccine lymph can be increased with the existing staff and equipment up to 16 million doses. Scheme to this effect is being put up to the Government. Approximate expenditure: (1) Non-recurring-Rs. 3,38,600 and (2) recurring-Rs. 3,25,848.
11.	West Bengal. Vaccine Institute, Calcutta.	1956— 1,00,98,000 1957— 1,51,95,000 1958— 1,47,00,000	There is possibility of increasing the output of vaccine lymph. Further information has not yet been received.

### APPENDIX III.

#### **"Piecemeal" Mass Vaccination Drive against Smallpox in U.P.**

(A note prepared by U.P. Health Authorities)


It is a well recognised fact that the manner in which vaccination against small-pox has been carried out during the last few decades by the Vaccinators has not been satisfactory. One Vaccinator, required to vaccinate a population of roughly 60,000 in 150 villages, is grossly insufficient. The result is that many villages are not visited even once in a year, or are possibly neglected for a longer period.

With the appointment of Village Level Workers, with vaccination duties entrusted to them, better results were anticipated. But, on account of greater stress on Agricultural production, the Village Level Worker is not giving the required attention to vaccination work. Even when compulsory vaccination is extended to rural areas, much good will not accrue, because enforcement of legislation is not easy. If the entire mode of vaccination is changed radically and reorganised properly, better results can be obtained. The following scheme of "Piecemeal Mass Vaccination Drive" is submitted :—

The district can be divided in Block and non-Block areas for purposes of vaccination. Roughly 50 per cent rural population has been covered by the NES/CD/Normalised Blocks in all the districts.

#### **BLOCK AREAS :—**

In Block areas the following staff will be available for utilisation on vaccination work :—



<i>Category of staff</i>	<i>Number available</i>
Village Level Workers	10
Block Sanitary Inspector	1
Block Health Visitor	1
Circle Vaccinator	1
Asstt. Supdt. of Vaccination	1
Epidemic Assistants	1 or 2
Total	15 or 16

Population of one Block is approximately 60,000 and number of villages is about 100. Mass vaccination work by the team will be concentrated only in one block, for one week, covering about 25 villages in a week. Thus, each Block will have to spare its staff only for one week, after every 5 to 6 weeks, depending upon



the number of Blocks established in the district. For instance, in Bareilly district, 6 Blocks have so far been established. Thus, Block staff will be utilised only for one week after every 6 weeks. In the entire vaccination season of 5 months, from November 1 to March 31, only 4 rounds of one week's working in a Block, after a lapse of six week's interval, will be carried out.

In this way, about 3,60,000 population in Block areas alone (approximately 50 per cent of rural areas) will derive the benefit of saturated smallpox vaccination. Besides, work would also be progressing in non-Block areas by the regular vaccination staff, who would cover another 20 per cent of the population. This will be enough to build up herd immunity in the district. In two years working, complete immunity can be built up in the entire district.

#### ACTUAL MODE OF WORKING

The total number of Vaccinators will be divided in 2 batches of 7 to 8 each, and each batch will be under the supervision of an Epidemic Assistant/Asstt. Superintendent of Vaccination. The batch of Vaccinators will be taken to the villages in Block Jeep/P.H.Van. Each batch will be able to cover 2-3 villages each day. Whenever a village is visited, health education will be imparted to the masses with the help of a loud-speaker, which is invariably available with the Block Development Officers. The field work in a Block will last for the first five days of a week. On Saturday, statistics will be compiled and consolidated and handed over to the circle Vaccinator.

Block Development Officers will arrange to get the vital statistics compiled and completed before the work starts in their circles.

#### NON-BLOCK AREAS.

Work in these areas envisages co-operation and utilisation of the services of the staff of the sister organisations of Public Health Department, viz., Anti-Malaria organisations in the non-spraying season, and also of the Revenue Officials.

As regards training in the technique of smallpox vaccination of the field staff of other departments, an attempt was made to impart this training at Tehsil headquarters of the district after obtaining names of volunteers from the respective local heads of offices. But it was found that :—

- (i) the trainees could not maintain their attendance and interest for the entire period of training.
- (ii) owing to exigencies of service elsewhere, the personnel so trained were not always available as and when desired for this particular work.

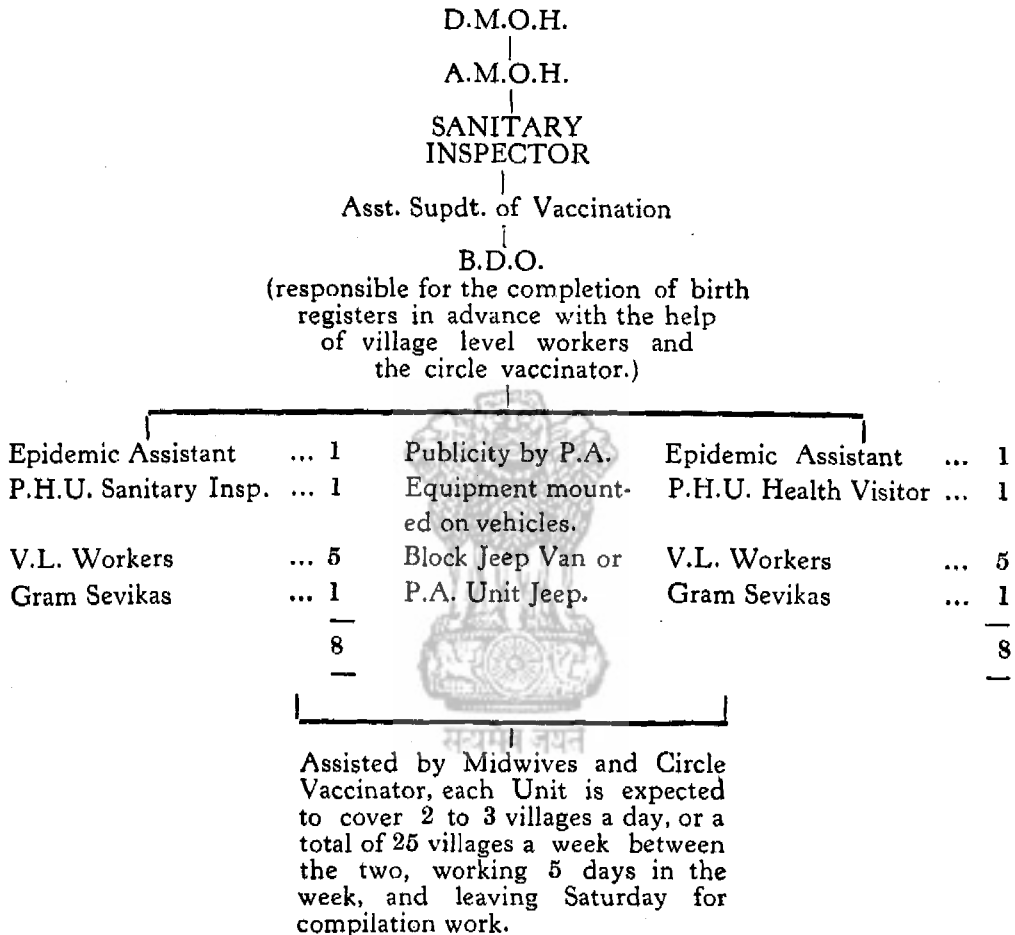
This can be remedied only if the higher revenue authorities and other heads of departments are approached at the Secretariat level for full co-operation.

# ORGANISATION OF SMALLPOX VACCINATION IN BLOCK AREAS OF THE DISTRICT

## UTTAR PRADESH

Population 60,000

Number of villages : 100-110



N.B.—4-5 visits in a block in 5 months will completely saturate the population with smallpox vaccination.

80 man-hours vaccination work in a day—400 man-hours in a week—9,200 man-hours in 23 weeks (5 months).

# APPENDIX IV.


## Particulars of Mass Vaccination Drive Conducted in Nine Taluks of Mysore State

*Taluks :—Tumkur, Gubbi, Chikanayakanah, Pavagada, Sira, Turavekere, Chamarajanagar, Yelandur and Magadi.*

Particulars	Total	
	Rural	Urban
1. Population ... ..	8,83,436	85,165
2. No. of villages ... ..	1,693	6
3. Actual No. of days the programme was worked ... ..	175	51
4. No. of staff members engaged in the Campaign :		
(a) Junior Health Inspectors ... ..	126	21
(b) Vaccinators ... ..	44	8
5. Total No. of vaccinations done :	4,72,977	52,330
(a) Primary vaccinations ... ..	51,552	3,194
(b) Revaccinations ... ..	4,21,425	49,136
6. Percentage of population protected ... ..	53.5	62.6
7. No. of vaccinations per head per day ... ..	159	195
8. Cost of petrol, oil, etc., (in rupees) for transport vehicles ... ..	3,099.83	Nil
9. Pay and allowances, including T.A. etc., paid to the staff for the duration of the campaign		
(a) Vaccinating Staff (in rupees) ... ..	16,105.92	1,670.00
(b) Drivers, Cleaners, Peons and 2nd Division Clerks ... ..	3,834.84	—
10. Contingent expenditure (Soap, Rectified Spirit, Towels, Match Boxes, etc.) ... ..	1,571.98	450.50
11. Total expenditure (in Rupees) ... ..	24,612.57	2,120.50
Grand Total ... ..	Rs. 26,733.07	

- N.B.—*(1) The cost of petrol, oil etc., is not heavy as most of the Vaccinators used their own conveyances.
- (2) The cost of supervision is also small as only one or two Health Inspectors used to be placed in charge of the mass vaccination drive.
- (3) Inspection of vaccinations done used to be done by the usual Vaccinator of the area after the mass vaccination drive.
- (4) Minimum record keeping was done for the mass vaccination programme and hence no extra expenditure on Stationery and Clerks was incurred.

**Range,**



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Date.....

from the King Institute, Guindy, by

District, during the month of

[illegible]

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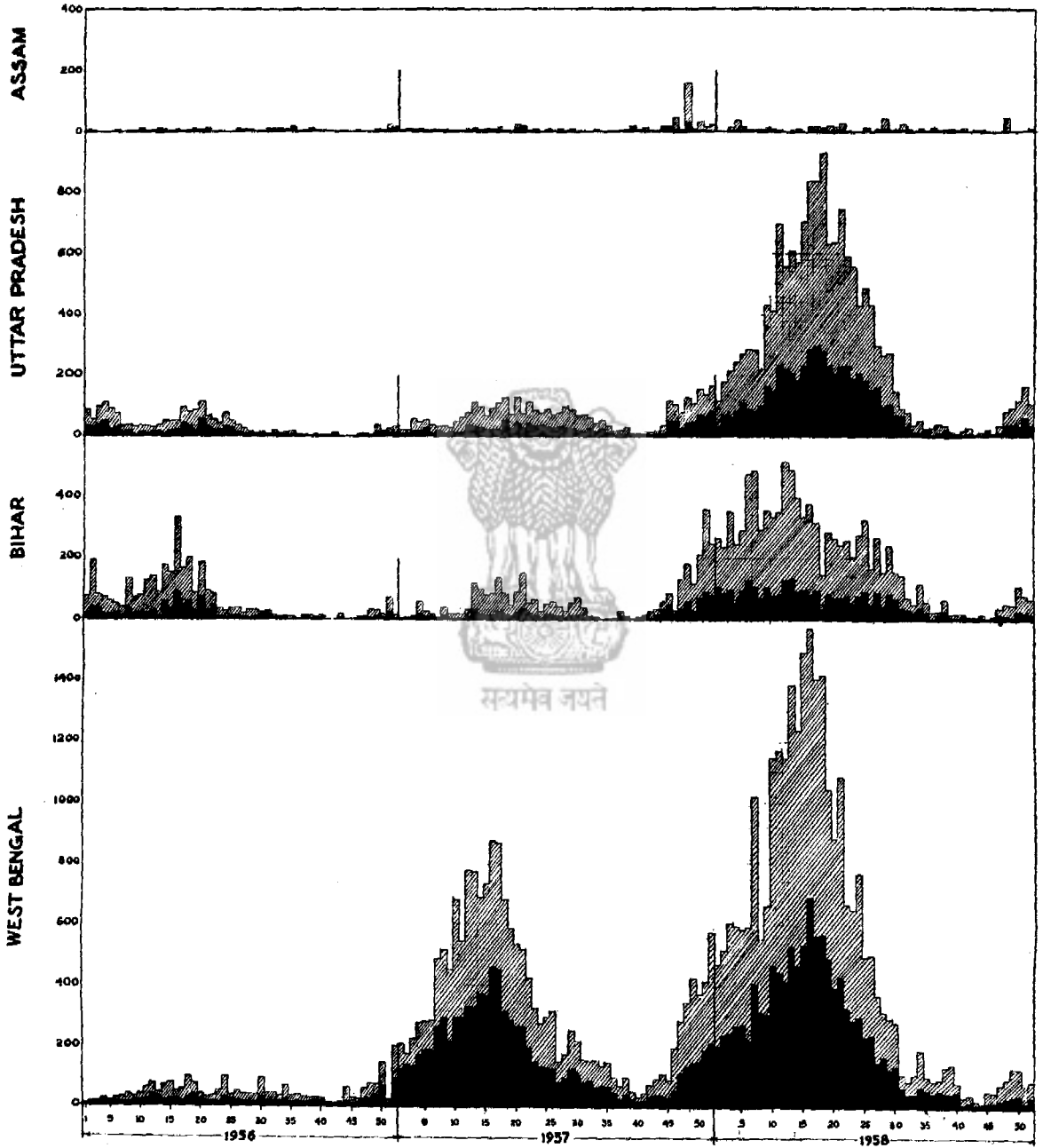
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# SMALLPOX

## WEEKLY ATTACKS AND DEATHS

1956-1958

INDEX



ATTACKS DEATHS 

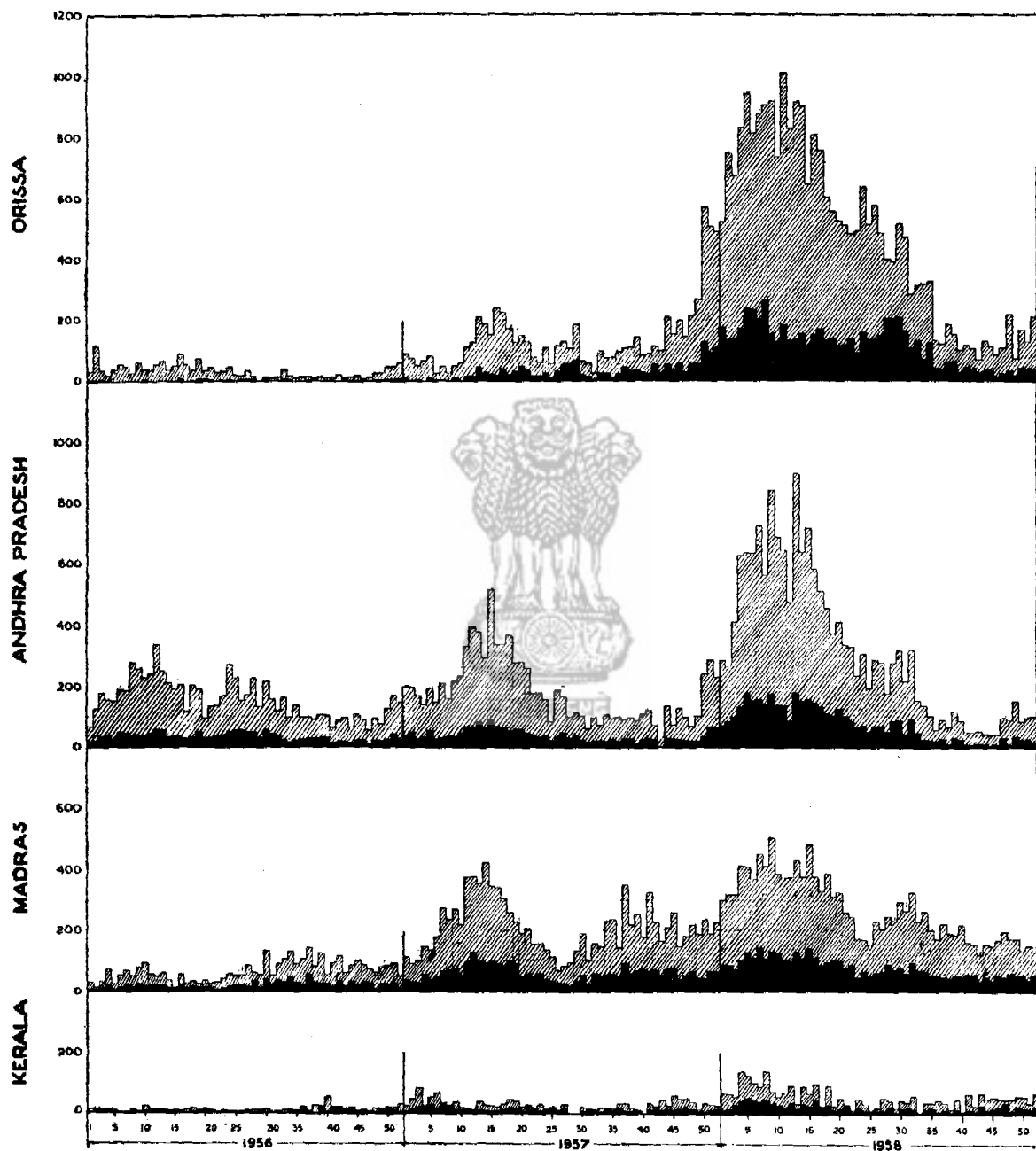


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# SMALLPOX WEEKLY ATTACKS AND DEATHS

1956-1958  
INDEX  
ATTACKS   
DEATHS 





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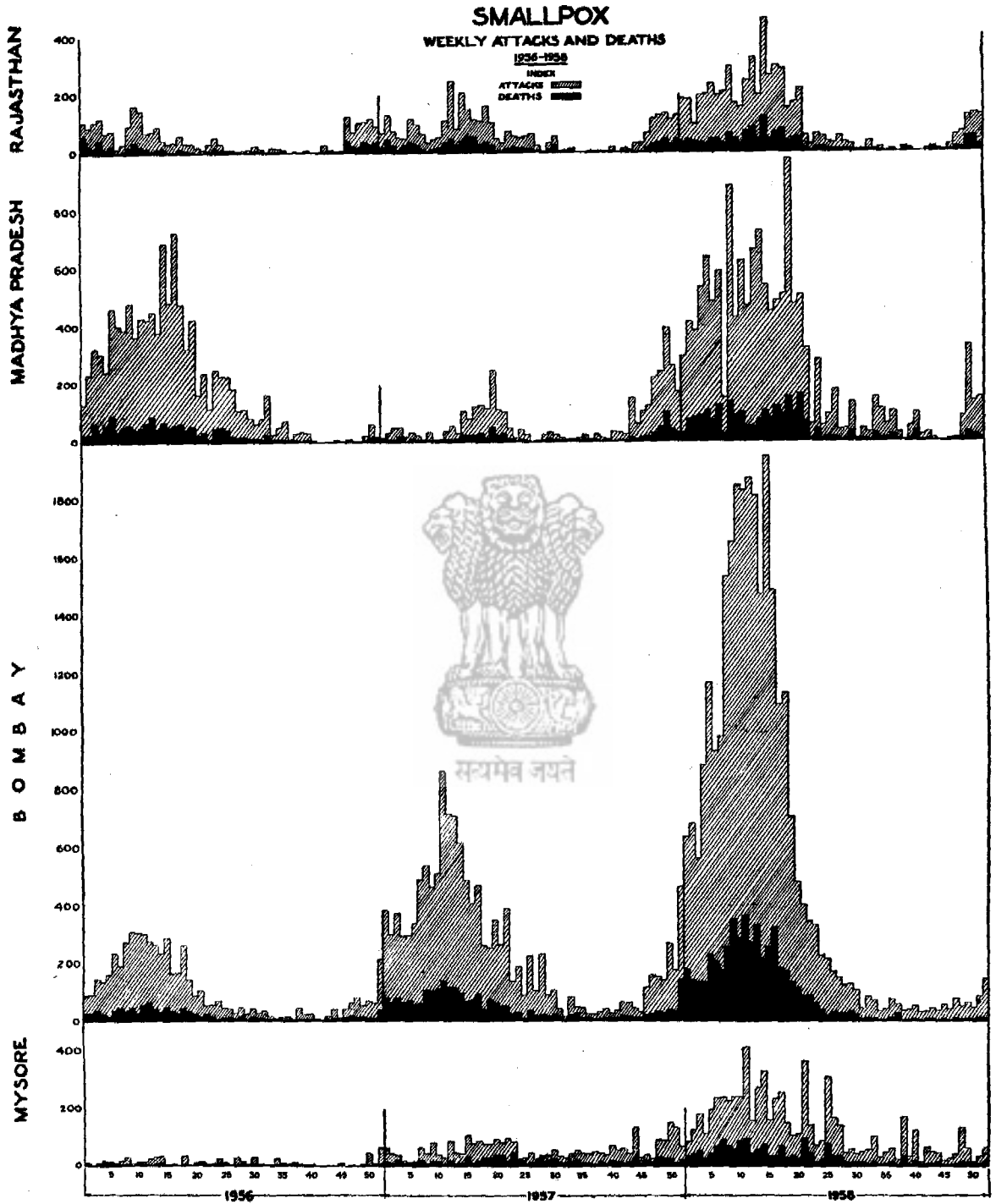




CHART IV.

**SMALLPOX IN INDIA**  
ANNUAL SPECIFIC DEATH RATES PER 100,000 POPULATION  
IN DIFFERENT STATES  
1946-58

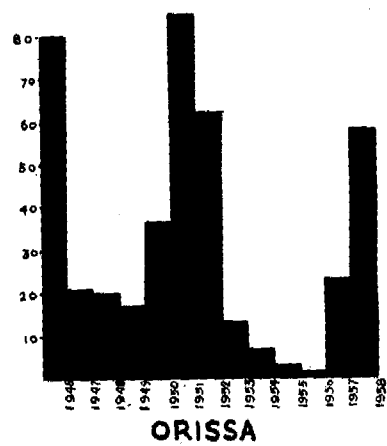
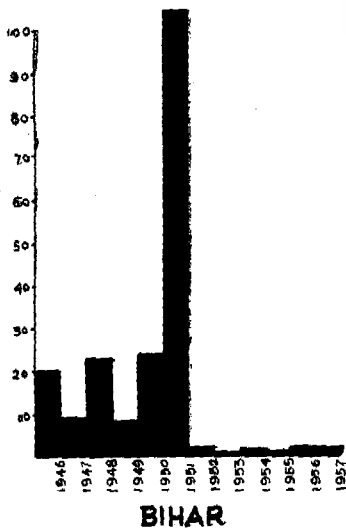
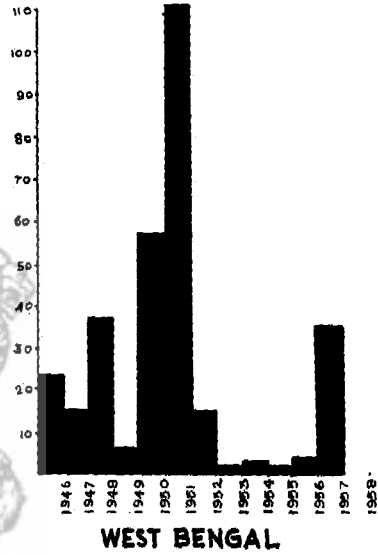
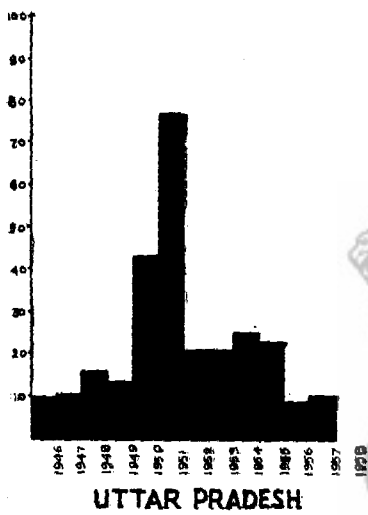
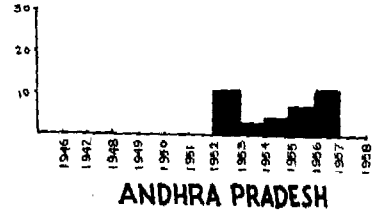
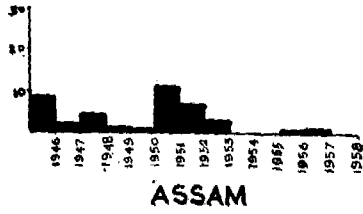
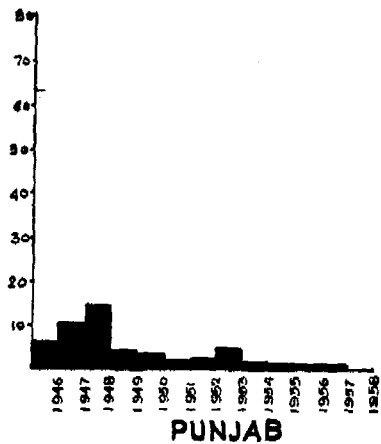
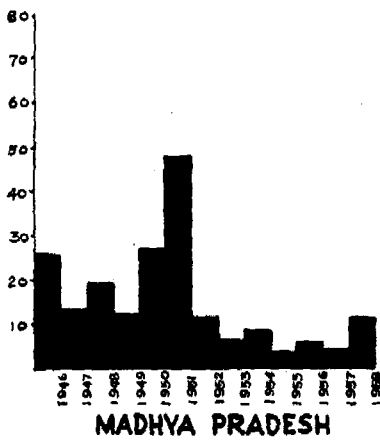
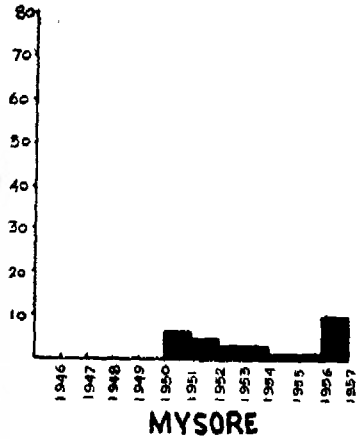
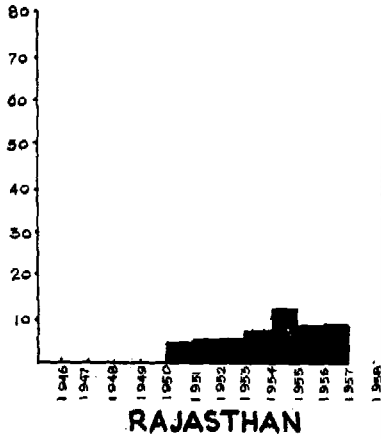
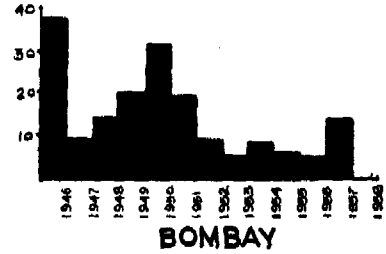
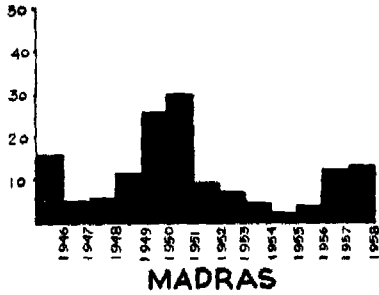




CHART V.

**SMALLPOX IN INDIA**  
**ANNUAL SPECIFIC DEATH RATES PER 100,000 POPULATION**  
**IN DIFFERENT STATES**  
 1946-58







PART II

REPORT OF THE JOINT COMMITTEE  
IN REGARD TO  
CONTROL AND ERADICATION OF  
CHOLERA





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## I. PREAMBLE

Epidemics of cholera in India have been reported since time immemorial. Indeed, India has earned the unenviable reputation of being the "home of cholera". From India, infection spread in the past to other countries by sea and land routes. There were, however, areas outside India where cholera epidemics occurred from time to time, but the focus of infection of any magnitude was the Yangtse Valley region of China.

Cholera has been either eradicated from, or brought under control in, most of the infected regions, including the Yangtse Valley region of China, by bringing about improvement in environmental sanitation and preventing re-entry of infection by appropriate quarantine measures in conformity with the W.H.O. International Sanitary Regulations. In recent years, epidemics of considerable severity have, however, occurred in countries other than India, e.g. in Egypt in 1947 and in Thailand (Bangkok) in 1958 and 1959. It is commonly believed, without adequate scientific evidence no doubt, that the infection found entry there from India.

The eradication of cholera is entirely dependent on the effectiveness of measures in respect of environmental sanitation. The Government of India, alive to this need, have given due support to the improvement of environmental sanitation in their First and Second Five Year Plans. It is realised, however, that the task is of a very great magnitude and that the achievement of the goal will take some time. It may be added that, in India also, cholera has ceased to be a problem in areas where environmental sanitation has received proper attention. It is not to be forgotten, of course, that there are many lacunæ in our knowledge of this disease and those have to be filled before unfailing measures can be devised for the total eradication of cholera. All the same, it is possible to control the disease with the utilisation of the knowledge already available. The Joint Committee kept this aspect in view during its deliberations.

## II. INCIDENCE

The incidence of cholera in the constituent States of India in the years 1948-58 is given in Appendix I. As will be seen from the tables in Appendix I and the charts that follow Appendix VI, case mortality rate, approximately the same in all the States, amounts to 40 per cent. This high mortality is probably the result of inadequate facilities for early treatment. It will also be apparent from the charts that the incidence of cholera is of considerable magnitude in West Bengal, Bihar, Uttar Pradesh, Orissa, Andhra Pradesh, Madhya Pradesh, Bombay, Madras and Mysore. At present the incidence is low in the Punjab, Assam and Kerala and it is not a major public health problem in Rajasthan and Jammu and Kashmir.

The incidence of cholera is more marked in most States in the second half of the year in contrast to smallpox which is most prevalent in the first half of the year.

During the current decade, there have been two major outbreaks of cholera in some States—one in 1952-53 and the other in 1957-58. Broadly speaking, there is an exacerbation of the disease once every five years or so. However, when the figures of the previous decades are seen, indications in the overall picture are that the disease is diminishing in intensity in most parts of the country, probably as a result of adoption of proper public health measures. Whether this trend will continue remains to be seen.

### III. EPIDEMIOLOGY

#### Endemic Zones

It is known that cholera is endemic in some parts of India and occurs epidemically in others. The endemic zones were initially demarcated in 1874 by Mr. Bryden, who was at the time the statistical officer in the office of the Sanitary Commissioner of the Government of India. His observations in this regard were confirmed by Bellew in 1884. As a result of studies carried out in India in recent years, and adopting a definition of endemicity based on certain statistical considerations, it has been found that the areas demarcated by Bryden and confirmed by Bellew still continue to be the endemic areas of cholera in the country. These areas lie in the deltaic regions of rivers flowing into the Bay of Bengal. The extent of each such area is in proportion to the size of the delta. Those of high endemicity, as accepted today, are :

1. The main area which lies in the very extensive Ganges-Brahmaputra delta in West Bengal and East Pakistan.
2. Two areas, which are horn-like extensions of the Bengal area, one lying in the Sylhet district of Pakistan along the Surma river and the other in Assam along the Brahmaputra river.
3. Inland areas which lie in the Ganges basin in Bihar and Uttar Pradesh. They are situated in the deltas of the rivers Kosi, Gandak, Sone, Gogra and Gomti where they join the Ganges in deltaic fashion.
4. Area formed by the estuaries of the three rivers of Orissa, the Barbalang, the Swarnarekha, the Mahanadi, and the Chilka lake.
5. The deltaic areas of the Godavari, the Krishna and the Cauvery which form three distinct foci of infection in the South.

It may be mentioned that the west coast of India is free from endemic foci of cholera and even the deltas of the Indus, the Narbada and the Tapti are clear. The most important of the areas of endemicity is that which lies in the Ganges delta in West Bengal. This has been regarded as the permanent home of cholera

in India. It must be mentioned, however, that, while West Bengal has come to be called the home of cholera, in reality the area involved is the whole of Bengal of pre-partition days. The influence of the partition of India, if any, on the spread of cholera in the north-east direction, will be referred to when dealing with the epidemiology of the disease in Assam. The endemic area next in importance is the Mahanadi delta area in Orissa. The areas in Godavari and Krishna deltas in Andhra Pradesh and Cauvery delta in Madras State are mostly confined to the deltaic regions below their respective anicuts, and to the parts irrigated by a system of canals issuing from the anicuts. In the rest of the country, cholera occurs periodically only in an epidemic form.

#### (a) FACTORS INFLUENCING ENDEMICITY AND EPIDEMICITY OF CHOLERA

The factors responsible for persistence of infection in endemic areas are not yet fully understood. This matter has been the subject of intensive investigation for several years. Taylor, in his comprehensive review of cholera research in India between 1934-40, summarised the results of an investigation of the endemic factors in the Khulna district of pre-partition Bengal as follows :—

“It has always been a matter of speculation as to how cholera infection persists in an endemic area and the possibilities may be—

- (a) by direct transfer from case to case,
- (b) by persistence in the cholera convalescent or healthy carrier,
- (c) by survival, with or without multiplication, in infected water.

“The Bengal field cholera enquiry, on a sounder basis both in regard to the diagnosis of V. Cholerae and in technique for differential isolation of the vibrios than had previously been employed, was in a position to obtain information relative to these points.

“The finding of this enquiry, that V. Cholerae could not be isolated from the stools of the general population or from water in the endemic area, except in direct relation to the cholera case, while the vibrio could readily be isolated from the case, direct close contacts and water in the immediate vicinity for a short period only from the onset of a case, would appear to suggest that carriers or water sources do not form permanent reservoirs of infection. Although finality cannot be claimed for the results of an investigation of this nature and the technique used may not have been able to detect a low level of infection in stools and water, the results are sufficiently definite to reinforce previous ideas on the subject and to make for confidence in applying preventive measures based on the findings. The cholera case itself would appear to be the major factor in disseminating infection and close contact carriers and water sources infected from the case may act as intermediaries for short periods and at short range. A heavy recent

infection of water may constitute an important source of infection and there are well-authenticated instances of this.

"The problem of primary importance in the epidemiology of cholera is the existence of areas in which cholera is permanently present. These endemic centres form a menace to adjoining areas for which they constitute a continuous reservoir of infection and their existence also necessitates quarantine supervision for the protection of countries to which infection may be carried by sea.

"Over the greater part of India cholera only occurs in epidemic waves at intervals and infection does not persist from one season to the next. A re-introduction of infection at a favourable season is necessary to start an epidemic and the primary source of infection is the endemic area. The cholera problem in India is consequently that of the endemic areas whose existence constitutes a permanent threat to the rest of the country." Investigations carried out during 1949-50 in the endemic region of Cauvery delta in Madras State supported these observations of Taylor.

The occurrence of cholera in epidemic form is dependent on several factors. It is essential, therefore, to study methodically the actual course of an epidemic in a State from the time it starts to the time it subsides in order not to miss out important facts. Some States have no doubt attempted to do this, but the efforts have not always been such as to yield conclusive information about the outbreaks. Detailed studies have been carried out in Uttar Pradesh, Assam and Madras, and recently in West Bengal, Bombay and Mysore, which have brought to light the existence of some areas in the States from which the epidemics originate. These areas act as foci for the spread of infection, primarily within the State, and subsequently to areas outside the State. It would appear, however, that the epidemiology of cholera has been studied hitherto more or less in isolation in the affected States and no systematic attempt has been made to correlate the information so gathered in order to get a clear idea of the spread of infection from one State to another.

The role of rail, river and road traffic in the spread of infection deserves mention. On occasions, a rail passenger suffering from cholera can be responsible for spreading infection, as happened some time ago in Assam, when one such passenger spread the infection in over 600 people at destination. A study of the epidemic of 1958, to which reference will be made later, has revealed that the initial spread of cholera in the States of Madhya Pradesh and Bombay occurred probably along the railway routes. It is quite likely that the spread of cholera in West Bengal, Bihar and Uttar Pradesh is influenced a great deal by rail and river traffic.

Regarding the role of rivers in the spread of cholera, experience in India has shown that they also play an important part in the dissemination of infection. Assam had a great epidemic in Surma river valley in 1933 which was caused by the spread of infection downstream from a focus in the upper reaches of the river in the Lushai Hills where cholera first broke out in the immigrant labour. The infection



ultimately reached the borders of Bengal. Epidemiological studies in Bombay State have shown that, once a river-side town or village gets infected, the infection travels downstream to other villages, sometimes at great speed. The importance of canals and small irrigation channels in this connection should not be overlooked. Indeed, in certain areas in Madras State, rapid dissemination of cholera in canal-irrigated areas has been frequently observed. Recent epidemics in Mysore State also seem to have resulted from spread of infection through such watercourses.

As for road traffic, it is obvious that infected travellers would carry infection wherever they go and spread it if they are of careless habits.

Another matter worthy of note is the role of fairs and festivals in the dissemination of cholera. It may be mentioned in this regard that the importance of fairs and festivals has been recognised since long, as is evident from the fact that in 1912 the Government of India appointed Pilgrim Committees to examine this question. These Committees recommended adoption of control measures not only at the sites of fairs and festivals but also along the routes taken by the pilgrims to and from the places where they are organized. The fairs and festivals are of two kinds: (a) those of a major nature which are organized once every few years and attract pilgrims from all over the country and (b) those, either major or minor, which are organized regularly in a region and attract pilgrims normally from the neighbouring areas. The extent of the area covered by the fair or festival is usually dependent on the religious significance and importance of the occasion. In the case of festivals of the first type, such as the Kumbhmela at Allahabad and Hardwar, Pushkaram festivals in the deltaic regions of the Krishna and Godavari and the Mahamakkam festival in Madras State, it is now customary to take adequate preventive measures well in advance, with the result that these centres have now ceased to be foci for the spread of infection. The experience in the Punjab in this connection has also been similar. The adoption of suitable preventive measures at festival centres like Hardwar and Kurukshetra has kept the State free for a good length of time from visitations of cholera. Previously, periodic occurrence of epidemics led to discussions whether Punjab was one of the endemic foci of cholera in the country.

Fairs and festivals belonging to the second type do not seem to have received adequate attention. The study of the 1958 epidemic clearly indicates their role in the dissemination of cholera. According to the Health authorities of Bombay State, it would appear that about a thousand pilgrims from Nagpur, who attended the Car festival at Puri, were responsible, on their return, for the spread of infection in a wide region extending upto Surat on the west coast of India. Similarly, pilgrims from the south, where cholera was epidemic, brought the infection to the Srishailam festival centre at Kurnool, from where it spread to the adjoining areas of Bombay and Mysore States. Similar occurrences must be taking place at other festival centres as well. It is, therefore, obvious that a careful study of the role of these centres in the spread of the disease is essential.

## (b) SPECIAL FEATURES OF THE EPIDEMIOLOGY OF CHOLERA IN THE STATES

## 1. West Bengal

The epidemiological features of cholera in West Bengal have been studied in some detail in view of the fact that this State is the "home" of cholera. These studies have shown that Calcutta and its environs are a continuous source of infection and are responsible for a major proportion of cases occurring in the State. The incidence seems to be particularly high in what is known as Central Calcutta which comprises localities situated along the banks of the river Hooghly and the two canals arising from it. Incidentally, these are the localities in which the percentage of slum or "bustee" population as well as the average population density are high.

It is interesting to note that in this area are located the termini of the two principal railway systems which connect Calcutta with the rest of the country and it is along their routes as will be shown later, that the spread of infection appears to occur.

The infection in Calcutta is present throughout the year and has its peak incidence in the months of April, May and June. Peculiarly enough, it is during these very months that the chemical composition of the water of the river Hooghly, especially in respect of salinity, albuminoid ammonia and pH, is favourable for the multiplication of cholera vibrio.

Another interesting feature is that there are also seasonal spurts in cholera incidence in Calcutta which coincide with the two major religious observances, viz., "Ramzan" and "Gajan" which last for almost a month and are observed by the Muslims and Hindus respectively. The outbreaks apparently have some relation to the intensity of fly breeding. It is stated that flies are more responsible for the outbreaks than any other single factor.

It might be mentioned that Calcutta City has a dual system of water supply. Filtered and chlorinated water is provided side by side with untreated raw water from the river Hooghly in many parts of the city. It is interesting to note that cholera vibrios can be isolated regularly, throughout the year, from raw Hooghly water. When both treated and untreated water supplies are available, it is not unoften that, due to scarcity of treated water in some localities, untreated water is used. Even so, it would appear that the incidence of cholera during the last ten years has shown a gradual decline. It must be noted in this connection that all cases of gastro-enteritis in Calcutta which simulate cholera are regarded and reported as cases of cholera.

In regard to the rest of West Bengal, it would appear that the incidence of cholera is heavy in urban and industrial areas and not in rural areas. An interesting observation has been that a large number of villages do not get cholera for two years in succession.

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\*(1) Chatterjee *et al.*, 1959, *Ind. Jour. Pub. Health*, 1959, **3**, 5.

(2) Seal, S.C., Personal communication.

Recent studies of the epidemiology of cholera in the State as a whole have brought out certain interesting features (Map 1). It is found to be prevalent throughout the year in certain districts of the State, with peak incidence in April and May. The districts can be arranged in three groups according to the pattern of occurrence of the cases (Chart I). The districts of Calcutta, Howrah, Hooghly, 24-Parganas and Midnapur form one group where cholera is endemic or hyperendemic. The districts of Bankura, Burdwan, Birbhum, Nadia and Murshidabad, which are more or less adjacent to the above-mentioned zone; constitute the second group where cholera can be considered to be endemic, although with incidence of a low magnitude. The districts of Maldah, West Dinajpur, Darjeeling, Jalpaiguri and Coochbihar form the last group where cholera is not a major problem when its incidence is compared to that in the districts of the first two groups. Thus, it will be seen that, as one moves away from the hyperendemic zone, the incidence of cholera diminishes. This suggests that the involvement of other areas in West Bengal is usually dependent on the intensity of the infection in and around Calcutta.

## **2. Bihar**

Bihar can be divided into three regions, North Bihar, South Bihar and Chota Nagpur, each of which probably has a distinct cholera history. Some areas bordering on Nepal, like Champaran, get the infection sometimes from the Terai region of Nepal. With the exception of Chota Nagpur, to which reference will be made later, the rest of the State, is well served by river, road and rail communications, appears to get the infection from West Bengal.

While sporadic cases of cholera in Bihar are reported throughout the year, epidemic outbreaks occur only during the months of May to October, with peak incidence between July and September. The infection apparently starts in urban areas with the onset of summer and is associated with extensive fly breeding which takes place in trenching grounds, insanitary latrines and refuse dumps. It must be noted in this connection that there is no sewerage system in any town in Bihar except Jamshedpur. The epidemic outbreaks in the months of May and June usually occur in certain parts of the State, namely, Gaya and Patna districts, through which the pilgrims pass on return from Gangadasserah mela in Banaras. The peak incidence in September is also apparently associated with other fairs and festivals in the State.

## **3. Uttar Pradesh**

Uttar Pradesh is an important pilgrim centre and it appears that the incidence of cholera in this State, particularly common in autumn and summer months, is intimately related to pilgrim traffic. From the epidemiological studies carried out in this State, the authorities have come to believe that in no part of U.P. is cholera really endemic and that, more often than not, the incidence is due to the importation

of infection from the adjoining States, particularly Bihar and Nepal. Once the infection finds entry, epidemics break out and U.P. acts as a relaying centre for the spread of infection to other adjoining areas. However, the public health authorities of the State do not rule out the possibility that, after the epidemic outbreaks in summer and autumn months, the infection may remain in the convalescent carriers or may persist as sub-clinical and inapparent infection. But persistence of sub-clinical infection has not been demonstrated in endemic areas where the problem has been specifically investigated.

Bacteriologists have failed to isolate cholera vibrios from cases of illness simulating cholera in many epidemics in U.P. The authorities, therefore, have labelled such outbreaks as being caused by organisms other than true cholera vibrios. Such practice is not in vogue in other States in India and, therefore, it is difficult to make any comparison between the incidence of cholera in U.P. and that in other parts of the country where cases simulating cholera are shown as cases of true cholera.

#### 4. Punjab

Till 1947, the Punjab had a well-functioning epidemiological bureau for the continuous study of infectious diseases. However, since the partition, no serious attempt has been made to conduct epidemiological studies in respect of cholera and smallpox. The public health authorities propose to undertake such studies in the near future. Broadly speaking, cholera has ceased to be a problem of public health importance after the institution in recent years of suitable preventive measures at some of the festival centres of the State.

#### 5. Assam

Epidemiological studies in pre-partition days led to the belief that infection was almost always introduced from Bengal. Once the infection found entry, it usually travelled by rivers down-stream, especially in the Surma river basin and, to a certain extent, in the Brahmaputra valley. Prior to 1919, the tea garden districts of Sibsagar and Lakhimpur were frequently affected by cholera. In 1919, the tea garden owners adopted the policy of compulsory inoculation of labourers before they were allowed to leave the recruiting depots in different parts of India. No mass inoculation was carried out in the tea gardens. Since then, the two districts have enjoyed freedom from cholera. The comparative incidence of cholera in different districts of Assam is given in Chart II. An interesting feature that has been observed in the study of the recent trends of cholera in Assam is the marked decline in its incidence. A scrutiny of the annual incidence rate in the last 10 years indicates that, after the partition of Bengal, Assam has enjoyed relative freedom from the disease, even in the districts adjoining the Pakistan border, namely, Goalpara and Cachar. The restriction of movement of the people across the border has probably helped in limiting the spread of infection from East

Pakistan, a known endemic area, to Assam. This aspect merits further detailed study.

## 6. Orissa

In Orissa, no epidemiological studies have been undertaken. The endemic zone of the Mahanadi delta lies in this region. General experience has been that epidemics of cholera occur twice a year, once in summer and autumn, and then again in winter. The fact that there are many festival centres in Orissa, some of which, like Puri, are of all-India importance, is probably responsible for the occurrence of these epidemics.

## 7. Andhra

In Andhra, the epidemiology of cholera presents some peculiar features. It would appear that the outbreaks are associated with the importation of labour for agricultural purposes, first for sowing operations and later for harvesting the crops. The seasonal occurrence of the epidemics is from June to August and from November to January, coinciding with the influx of labour for the above-named agricultural operations. The same thing occurs in connection with tobacco cultivation for which labour from outside is imported for work in Krishna and Guntur districts during the months of January and February. The lack of proper arrangements in the labour camps, both in regard to the provision of safe drinking water and disposal of night soil, is an important factor in the onset and spread of infection in the labour communities. The role played by festival centres in this State in the spread of infection to other States has already been referred to.

## 8. Madras

Study of the incidence of cholera in this State in the last 30 years shows that the infection has persisted in four districts, namely, Tanjore, Tiruchirapalli and South Arcot districts, which together form the Cauvery Delta, and Tirunelveli district. In the last named district, the areas along the river Tambaravarani are particularly affected. The infected villages are mostly located on the banks of the numerous irrigation channels in the Cauvery delta. It is stated that these channels as well as the many rain-fed tanks which are liable to gross pollution are used by the people as water sources for all purposes, including drinking, washing, bathing etc., even though a number of protected wells have been provided in these areas.

The main cholera season in this State is winter, from November to January. The peak incidence coincides with the harvesting season.

It is of interest to note that in 1956 there was practically no cholera in the whole of the State. During the 3rd week of February, 1957, cholera broke out in a few villages in Tiruchirapalli district. The source of this infection could not be traced. From here the infection spread to almost all the districts in the State within a period of a few months. It may be mentioned in this context that the

infection is sometimes introduced into this State from outside, as was the case in 1942-43 when the origin of the epidemic was traced to Orissa and the old Hyderabad State.

In addition to the movement of population associated with harvesting operations, other factors like fairs and festivals also play an important part in the spread of the disease. There are nearly 200 major and 400 minor festival centres in this State. Ten of them are permanent pilgrim centres which attract pilgrims from all over the country. During the last several years, adequate permanent sanitary arrangements have been made in these ten centres and they have since ceased to be disseminating foci of infection. Similar precautions are being taken at other centres and that is probably responsible for the downward trend in the incidence of cholera that has been evident in this State during the last few years.

Cholera incidence in Madras State during 1957-58 is shown in Map 3.

### **9. Madhya Pradesh**

The epidemiology of cholera in this State is closely linked up with that in the adjoining States of Uttar Pradesh, Bihar and Orissa. While sporadic cases of gastro-enteritis are encountered throughout the year, epidemic outbreaks of cholera occur mainly during the months of May to October, with peak incidence between July and September. It is stated that the infection is generally imported through actual cases from the pilgrim centres at Allahabad and Banaras (Varanasi) in Uttar Pradesh, Gaya in Bihar and Puri in Orissa. As will be shown later, the 1958 epidemic was probably due to the importation of infection by pilgrims returning from the Car festival in Puri.

### **10. Bombay**

Cholera occurs mostly in an epidemic form in this State. Infection is almost always imported and appears in the wake of major fairs and festivals held in other parts of the country, probably U.P. and Orissa. A study of the 1958 epidemic shows that the infection was introduced from Orissa in the Nagpur region from where it spread to other parts of the State. It is interesting to note that the Saurashtra region is usually free from cholera. In 1957, however, an epidemic occurred there and was traced to pilgrims returning from Mathura in Uttar Pradesh. The State public health authorities have observed that, once the infection reaches a village on a river bank, its further spread takes place down-stream and explosive outbreaks occur. As in Bengal, an interesting observation has been that, after one outbreak, the affected villages remain free for two to three years in succession.

### **11. Mysore**

The epidemiology of cholera in this State is more or less similar to that observed in Bombay State. Rivers and streams play a major role in the dissemination of infection.\*Observations made by the State Public Health Authorities in the

course of the 1958 epidemic revealed some interesting features. The infection was predominant in about 12 taluks of the northern districts adjoining either the Bombay or Andhra State. Most of the infected villages lay alongside the rivers Krishna and Tungabhadra and their tributaries, and their scattered position in Haveri and Shirhatti taluks of Dharwar districts is shown in Map 2. It may, however, be noted that attempts to isolate cholera vibrios from those rivers and streams were unsuccessful. Epidemics of this nature, therefore, merit detailed studies.

## **12. Kerala**

Kerala has enjoyed relative freedom from cholera in the last 10 years except for two epidemics of some magnitude in the years 1950-51 and 1953-54. The State, it may be noted, is quite close to the endemic zone in the south with which it has frequent inter-communication, and has a population density even greater than that of West Bengal. It would be interesting to study the factor or factors responsible for the limitation in the spread of the disease in this State.

## **13. Rajasthan**

According to the State Health Authorities, cholera has not been a major public health problem in Rajasthan in recent years. Small isolated epidemics have occasionally occurred, as happened in 1950-52, and these were due to importation of infection through pilgrims returning from the fairs in Jodhpur, Jaipur and Udaipur Divisions. To deal with such epidemics, the health authorities undertake adequate preventive measures, e.g., (i) compulsory inoculation of pilgrims at certain key points along routes of travel, (ii) issue of railway tickets to pilgrims only on the production of cholera inoculation certificates, (iii) chlorination of water supplies in the festival areas, and (iv) prompt isolation of the sick in specially erected camps. It must be noted that the physical terrain and climate of the various parts of the State differ considerably; some are desert regions with very little rainfall, while others, like the Udaipur region, have moderate rainfall and considerable vegetation. The largest lake in the country is situated in this region. Thus, in spite of the fact that, some parts of the State, in virtue of their physical and climatic conditions, are as favourable for the spread of cholera as are areas in other States where epidemics are common, it is surprising that epidemics do not assume serious proportions in this State. Probably it is the prompt institution of preventive measures, as mentioned above, that limits the spread of epidemics in the State. If this is substantiated by further study, the experience of Rajasthan would be of interest to other States also.

## **14. Jammu and Kashmir**

There has been no epidemic of cholera in this State since 1950, but, prior to that year, periodic epidemics used to occur. Severe epidemics broke out during the

years 1914, 1915, 1935, 1944 and 1948, with attacks and deaths as shown below :—

<i>Year</i>	<i>Attacks</i>	<i>Deaths</i>
1914	6,334	3,547
1915	3,268	1,876
1935	3,219	1,816
1944	1,359	641
1948	18,027	10,799

The epidemics made their appearance in the latter half of the year. It is not known how the infection was introduced. The epidemiology of the disease would appear to have been more or less similar to that in the Punjab. It is reasonable to assume that the present freedom of the State from cholera is the result of the current freedom of the Punjab from that disease.

(c) GENERAL PATTERN OF SPREAD BASED ON THE STUDY OF EPIDEMICS  
DURING 1956, 1957 AND 1958.

In order to get an insight into the probable pattern of spread of cholera in the country, an attempt was made to analyse the statistical data furnished by different States to the Directorate General of Health Services, New Delhi. In analysing these data, certain assumptions were made. It has already been stated that West Bengal is probably the home of cholera and from there the epidemics have spread in the past to distant areas. It was considered desirable, therefore, to ascertain the extent to which that pattern of spread holds good today. If the infection were to spread from this area to other States, it would seem logical to assume that it would spread mostly in three directions : (i) north-westerly direction through Bihar to U.P., principally along the railway routes and water courses, (ii) southerly direction to Orissa, Andhra Pradesh and probably to Madras, and (iii) westerly and south-westerly direction from Orissa, through the adjoining areas of Madhya Pradesh, to Bombay and Mysore. If this is true, then sufficient evidence is available to indicate that the march of the epidemics through the different States has a time relationship as well as geographic contiguity.

In order to study the time relationship of cholera epidemics as they spread from State to State, the data relating to weekly attacks and deaths from cholera in each State during the years 1956, 1957 and 1958 were plotted in Charts III, IV and V and the States were arranged in groups in order of contiguity in the three major directions indicated above. The States and their boundaries are those which came into existence after the recent re-organization of States.

In the first group of States, comprising West Bengal, Bihar and Uttar Pradesh (Chart III) a definite time sequence in the peaks of incidence of cholera is apparent. As will be seen, in the year 1956, the incidence of cholera in West Bengal, showing a rising tendency from the latter half of March, has reached its



peak in the middle of May and tailed off by early August. There is also another peak in the last quarter of the same year. In Bihar, the highest incidence is noticed in July and August and again later in November. This indicates in a general way that the peaks in Bihar have followed those in West Bengal. Incidence in Uttar Pradesh, although not of the same magnitude, shows a similar time relation, particularly to the incidence in West Bengal. An almost similar picture presents itself in the years 1957 and 1958.

In the second group of States, comprising Orissa, Andhra Pradesh, Madras and Mysore (Chart IV), Orissa shows presence of cholera in an epidemic form of varying intensity throughout the period from mid-April to end December, 1956, with peak incidence in late August. The peak in Andhra Pradesh is in the middle of December. The epidemic in the early part of the year in Andhra Pradesh is a continuation of the epidemic of the previous year. In the years 1957 and 1958, the incidence follows more or less the same pattern, except that it has been noticeably higher in Andhra Pradesh. In the State of Madras, 1956 has been a quiet year, the total number of cases reported, but not charted, being 29, but the incidence has been high in the latter part of 1957 and the first quarter of 1958. In Mysore, the incidence has been low during 1956 and 1957, but quite noticeable between March and August of 1958, with peak incidence in June. In time sequence it appears to be related to the epidemic in Madras State. These aspects are discussed later.

In the third group of States, comprising Orissa, Madhya Pradesh, Bombay and Mysore (Chart V), the time sequence in the occurrence of cases is again evident, especially between Madhya Pradesh and Bombay.

A similar analysis of the available data for the earlier years of the present decade, made by Dr. Seal, has shown broadly speaking the same trend in time sequence in the spread of cholera in the States grouped in the preceding paragraphs.

Though the data presented above suggest the probable spread of infection from a central focus in the three main directions mentioned earlier, it is necessary to see that this assumption is borne out by the occurrence of cases in geographically contiguous areas in different States. It must of course be conceded that infection can travel from a central focus to distant parts, leaving intervening areas unaffected depending upon factors such as movement of population during fairs and festivals, modes of transport, etc. In addition, apart from the central focus, it is likely that the endemic foci in some of the other areas also play their part in the spread of the disease. What is attempted here is to indicate the broad pattern of spread of infection from one area to another in further corroboration of evidence obtained by the study of the time sequence of epidemics. The 1958 data in respect of cholera were, therefore, plotted in a series of maps, showing weekly figures of cases for the whole year. Ten representative Maps (4 to 13) are attached. In the shading of maps to indicate cholera infected areas, a whole district has been shaded even if only one case has occurred in it. A careful study of these maps has brought

to light two important features, viz. :—

1. That the disease spreads from one area to another in geographic contiguity.
2. That the appearance of cases in non-endemic areas depends entirely on the extent and intensity of infection in the neighbouring endemic zones, thereby indicating that the occurrence of cases in the former is triggered off by the infection lurking in the endemic zone.

Bearing these facts in mind, a scrutiny of the maps would show that the routes of spread in geographically contiguous areas are probably as mentioned below :—

- (i) Taking West Bengal as the starting point, the disease appears to spread from there to Bihar and Uttar Pradesh (Maps 8, 9 and 10) in one direction and to Orissa (Map 6) in the other. In Bihar, the first area to be affected is in the region of Patna and Gaya. This may be due to the fact that Gaya is an important pilgrim centre. Infection from Bengal appears to reach Banāras (Varanasi) in Uttar Pradesh, another important pilgrim centre, from where it might also travel down the Ganges and reach Bihar. It is interesting to note that the region around Patna and Gaya is one of the minor endemic foci in the Ganges basin referred to previously. This focus may be responsible for the spread of infection towards the Nepal border. (Maps 8, 9 and 10).
- (ii) The infection from Orissa seems to travel in a westerly direction to Madhya Pradesh through the districts of Raipur and Durg above Bastar area. (Maps 8 and 9). The relative freedom of Bastar from cholera is a rather interesting feature. The geographic formation of this area is not favourable for free communications and thus discourages travel through it. Also, this area is sparsely populated, the average density of the population being 54 per sq. mile. Infection from West Bengal does not normally spread to Madhya Pradesh through Chota Nagpur in lower Bihar. This is a forest region with few communications. Moreover, the aboriginal tribes predominantly inhabiting this region do not normally travel much outside the region. Indeed, during 1958, this area remained almost completely free from infection and there was only a small outbreak lasting a week or two.

From Orissa, the infection also appears to spread in the southern direction to the adjacent districts of Andhra Pradesh (Maps 11 & 12). Such a spread is particularly noticeable towards the end of the year. The lack of spread of infection by contiguity from Orissa to Andhra Pradesh in the first half of the year is worth noting. (Maps 4 to 9). The occurrence of cases in Andhra Pradesh during the early part of the year appears to be related to the waning epidemic in the State of Madras (Maps 4 and 5). It has been ascertained that in March, 1958, the infection

was introduced into Andhra Pradesh by the pilgrims returning from the South after attending the festival at Srishailam near Kurnool (Map 6). From this focus the infection spreads to other adjacent districts, including the districts of Raichur and Bijapur in Mysore State (Maps 7 and 8).

- (iii) The infection from Madhya Pradesh spreads westwards through the adjoining districts of Bombay. A glance at Map 9 would clearly show the spread of cholera from Orissa to Bombay by geographic contiguity. The cases have occurred, interestingly enough, in places situated along the main railway line that runs through these States. It has been possible to trace the spread of infection to pilgrims returning from the Car festival at Puri.
- (iv) As stated earlier, the infection from Andhra Pradesh has been responsible for the spread of the disease to Mysore and to adjoining areas in Bombay (Maps 7 and 8). It is, therefore, obvious that the infection in Mysore, which shows a connection with cases in Bombay in time sequence, is actually related to the epidemic in Andhra Pradesh, as a consequence of geographic contiguity.
- (v) The epidemic in the State of Madras in the first three months of 1958 appears to be the tail end of the epidemic which started there towards the end of 1957. However, in 1958, cases have been continuously reported from Madura district which is an important pilgrim centre. Epidemics in Madras are occasionally responsible for the spread of infection to Mysore and Kerala.

Study of these maps also helps to show that usually small nuclei of infection form along the routes of spread from the endemic zone—first in close proximity to the endemic zone and later to distal points. From these small nuclei the infection spreads locally in all directions. Exceptions to this pattern are also seen. It is not usual to find that, when infection is lingering in a region like Orissa, a small focus forms in some far off place in Bombay State (Maps 4 and 7). These cases may perhaps have a relationship to some concurrent infection in the adjoining territories of Andhra Pradesh.

Information about the incidence of cholera, as supplied by the States, is not always complete. However, study of what is supplied, indicates certain general trends. The infection in West Bengal appears to be the main source from which spread to other parts generally takes place. Persistence of infection, almost throughout the year, is observed in some parts of Orissa, Andhra Pradesh and Madras. Occurrence of cases of cholera in the States of Madhya Pradesh, Bombay, Mysore, Bihar and Uttar Pradesh is usually transient, limited to certain seasons and has a relation to the intensity of the infection in some of the neighbouring endemic zones.

Based on the observations made earlier, the main directions in which the 1958 epidemic progressed at different periods of the year are indicated in Map 14. It

must be remembered, however, that these are trends observed only in the course of one year. Obviously, it is necessary to make more observations to see the trends in other years.

It is possible that further evidence on the probable mode of spread of infection from region to region will be forthcoming from a study of the vibrio responsible for a particular epidemic, and its susceptibility or resistance to different cholera phages. The organisms commonly associated with cases of cholera have been grouped by Gardner and Venkatraman into six broad groups, depending on their biochemical and serological characteristics. According to the present accepted concept, the pathogenic organisms responsible for epidemics of cholera belong to O group I. There are, however, two sub-types in this group designated Inaba and Ogawa. It is common experience that one of these sub-types predominates in any epidemic of some magnitude. In a study conducted in South India in late thirties a change in the nature of the vibrio from year to year was observed. Initially there was a clear-cut distribution of the two sub-types, Inaba being prevalent in the Andhra region of old Madras State while Ogawa was found in Tamilnad or South Madras. In the city of Madras, both sub-types were found to be present. Since then there have been extensions and recessions of the areas in which either of the two sub-types was associated with epidemic outbreaks. In 1940, in the Andhra region of Madras State, a change occurred. Inaba came to be replaced by Ogawa sub-type. On the other hand, the predominant sub-type in the great epidemic of 1942-43, covering the whole of old Madras State, was Inaba which was found to have been introduced from Orissa (vide Map 15).

Typing of cholera vibrios responsible for epidemics in different parts of India might yield information of value in determining the inter-relationship of epidemic in different regions and the probable pattern of spread. Further confirmation may be obtained by studying the susceptibility of Vibrios to specific cholera phages. Such studies have been found to be useful in tracing typhoid epidemics. Development of appropriate techniques for cholera seems desirable.

It would also be desirable to correlate available data on a broad district basis, as has been shown in the maps, and to study those data in relation to the lines of communication, e.g., rivers, waterways, etc. That has not been possible in the present study. Such a study would throw further light on the spread of an epidemic from one area to another.

If the general hypothesis in regard to the spread of infection mentioned above is confirmed, it would serve to indicate the area or areas where concentrated action for the control of epidemics could be taken, with benefit not only to the area concerned, but also to the other parts of the country where periodic epidemics of cholera occur.

#### IV. PRESENT METHODS OF CONTROL OF CHOLERA

Information culled from the reports received from the States in regard to the control measures adopted by them against cholera reveals that, during epidemics, and, in some cases, before the anticipated epidemics, routine orthodox preventive measures, such as mentioned below, are adopted :—

1. Inoculation of the population of the affected or threatened area with cholera vaccine.
2. Isolation of cases in existing or improvised isolation hospitals.
3. Chlorination of water supplies in urban and rural areas.
4. Anti-fly measures to prevent spread of infection from excreta of infected persons to food.
5. Disposal of excreta by trenching in rural and in urban areas where no water carriage system is available; disposal by treatment in septic tanks in certain cases.
6. Disinfection of fomites, etc.
7. Control measures at fairs and festivals.
8. Propaganda against consuming foods, fruit, water, milk, etc., liable to contamination with cholera vibrios.

An attempt will now be made to describe in some detail some of the above-mentioned measures.

##### (a) USE OF CHOLERA VACCINE

Cholera vaccine is being extensively used in the control of the disease in all the States. In most cases, however, this measure is resorted to only when the infection has broken out or occasionally when it is round the corner. Systematic anticipatory inoculation campaigns are instituted only during major fairs and festivals, specially those which are of all-India importance.

Cholera vaccine is manufactured in the public health laboratories of nine States in the country, viz., Andhra, Assam, Bihar, Bombay, Kerala, Madras, Mysore, Uttar Pradesh and West Bengal and in the Central Research Institute, Kasauli (Appendix VII). The States of Rajasthan and Orissa have no facilities for the manufacture of vaccine and the Punjab receives its supplies from the Central Research Institute, Kasauli. Information regarding the newly constituted Madhya Pradesh is not yet available, but it appears that it receives its vaccine from Bombay as well as from the Central Research Institute, Kasauli. Even so, the quantities of vaccine manufactured in each State Laboratory are not always adequate to meet the demands of the State and, on many occasions, additional supplies are requisitioned from the Central Research Institute, Kasauli and the Haffkine Institute, Bombay. Orissa obtains most of its supplies from the commercial concerns in West Bengal.

The vaccine in current use is prepared from two strains, Inaba and Ogawa, in equal proportions, and a single dose of 1 c.c. of this vaccine is usually administered.

For inoculation campaigns in most States, the services of Assistant Health Officers, Medical Officers in-charge of dispensaries, Health Assistants, Sanitary Inspectors, etc. are utilized. During severe epidemics, additional staff is recruited for the purpose. From the reports received, it would appear that workers of voluntary organizations, like the Red Cross, St. John Ambulance and the Marwari Relief Society, participate in the inoculation campaigns only in the State of West Bengal. In certain States, village level workers and gramsevaks are also trained to do this work.

#### (b) ISOLATION OF CASES

Since frank cases of cholera form the main source from which the disease spreads, prompt removal of such cases to suitable treatment centres is of particular importance. At present, however, such facilities do not exist on an adequate scale in many of the States. In some of the major cities there are infectious diseases hospitals where patients suffering from communicable diseases like cholera, small-pox are isolated and treated.

Special wards for the isolation and treatment of cases are also provided in some of the headquarters hospitals, while at other smaller urban hospitals such facilities are created temporarily when epidemics break out.

So far as rural areas are concerned, it would appear that facilities for isolation and treatment of cases of cholera do not exist. Some attempts are, however, being made in the States of Bombay, Bihar and Madras to correct this position. In Bombay State, five self-contained mobile units have been established and these have been operating for the last 10 years. Each unit has :—

- (i) 25 big tents and 40 small tents to accommodate 50 beds and the staff.
- (ii) Two motor vans with trailers to carry the equipment and also to help in the removal of cases from the surrounding areas to the hospital.
- (iii) Personnel consisting of 1 Senior Medical Officer, 2 Junior Medical Officers, 8 Nurses, 4 Ward boys, 4 Ayahs, 5 Sweepers, 1 Compounder, 1 Clerk, 2 Drivers, 2 Cleaners, a Cook, a Dhobi and 3 Servants. (For equipment see Appendix V).

It is stated that, during a period of 10 years, over 17,000 cases of cholera have been treated by these units, with only 8 to 12 per cent mortality as against a mortality rate of 50 to 60 per cent among those not so treated. In Bihar, about 25 units, each with a bed strength of 10, are in operation and another 25 are contemplated. In Uttar Pradesh, 6 public health laboratory-cum-treatment units are envisaged, four at range headquarters on a regional basis and two at the headquarters for

dispatch to other areas whenever necessary. In Madras, cement platforms have been provided for creation of temporary hospital sheds whenever necessary.

It is obvious that extension of facilities mentioned above on a much wider scale is essential.

#### (c) CHLORINATION OF WATER SUPPLIES IN URBAN AND RURAL AREAS

It is customary during an outbreak of cholera to disinfect sources of drinking water, such as wells and tanks. The chemicals most commonly used for this purpose are either bleaching powder or potassium permanganate. The latter was used extensively following the recommendations of Hankin in 1898. However, in recent years, many public health authorities have expressed doubts about its efficacy in the control of cholera. The disadvantages in the use of potassium permanganate are many, the main ones being e.g., its high cost, slow action and unpleasant taste. There is also no quick method of testing in the field its disinfectant action. The use of potassium permanganate has, therefore, been discontinued in most places. It still continues to be used, however, in certain States in India, especially when bleaching powder is not readily available.

The methods adopted in different States in regard to the use of bleaching powder vary a great deal. In the Punjab, for instance, one ounce of bleaching powder is used for every thousand gallons of water. In Kerala, one "heaped dessert spoonful" is used for 300 gallons of water. In Rajasthan,  $\frac{1}{4}$  to 1 drachm is used for 100 gallons of water, depending upon the quantity of organic matter present in the water. In Bombay State, the amount of bleaching powder used amounts to  $1\frac{1}{2}$  ounces per 10,000 gallons of water. Water is tested 30 minutes after adding bleaching powder to it for a trace of residual chlorine. For the purpose of disinfection, special staff is maintained in some States, particularly in rural areas.

It will thus be seen that there is considerable scope for improvement in the use of bleaching powder in the field. It is, however, realised that when an epidemic of cholera has broken out or threatens to break out in areas where wells form the sources of drinking water supply, rough and ready methods have to be adopted to meet the needs of the situation.

#### (d) CONTROL MEASURES AT FAIRS AND FESTIVALS

The role played by fairs and festivals in the spread of cholera has been referred to in some detail in the section dealing with epidemiology. For over two decades now, adequate measures are being adopted in connection with major festivals which attract large numbers of people from different parts of the country. It must be noted that such festivals are generally of limited frequency and duration. The measures usually adopted are :—

- (1) Compulsory inoculation of the incoming pilgrims ;

(2) ensuring supply of safe water to the pilgrims, both at the place of the festival and sometimes along the routes by which they travel ;

(3) provision of facilities for isolation and treatment of cases. These measures are instituted well in advance in most cases.

It must be mentioned, however, that, in certain centres which attract pilgrims throughout the year, Puri and Banaras for example, arrangements on the lines indicated above are not always adequate. The same is true of minor fairs and festivals. Some States, e.g. Madras, have legal provisions for banning a festival at any centre, if cholera is prevalent in the neighbourhood.

## V. RECOMMENDATIONS

As stated in the preamble, the control and ultimate eradication of cholera can be achieved only through an all-round improvement in environmental sanitation, with special reference to proper disposal of sewage and provision of safe water supplies in areas where cholera is endemic. The Government of India have made provision for this purpose in the Second Five Year Plan and it is likely that augmented funds will be made available in the Third Plan to obtain expeditious results. It has to be realised, however, that it will take some time before the desired objectives in this regard are attained and the full benefits of efforts become readily discernible. It must be emphasised, however, that the knowledge which has accrued from past experience can be effectively utilised for the prompt control of cholera. For the sake of convenience, control measures for application in the endemic and epidemic areas are dealt with separately.

### (1) NEED FOR CONCERTED EFFORTS FOR CHOLERA CONTROL IN CERTAIN KEY AREAS OF ENDEMICITY

Preliminary studies by the members of the Central and State Expert Committees of the general trends in cholera during the last 10 years and specific trends in the last three years, as also a detailed study of the spread of the epidemic in 1958, have revealed the existence of certain areas where the infection is present almost continuously and from where it spreads to other areas in the country. It is obvious that immediate attention has to be paid to these areas to remedy the situation. However, instead of adopting the usual procedures, now in vogue, for the control of cholera, it seems essential to make an all-out effort to eradicate the disease from these areas. The measures will include improvement in environmental sanitation, with provision of safe drinking water supplies on a permanent basis. The other measures which are currently in use, such as the use of cholera vaccine, disinfection of water supplies, etc., will also have to be instituted. It is necessary that the eradication programme is carried out within a stipulated period, and that adequate funds are set aside for the purpose.

The measures suggested above are required to be undertaken in all the endemic areas. It may not, however, be practicable to deal with all such areas



simultaneously. Some action has already been taken in the Cauvery Delta. The heavy and periodic incidence of cholera in certain parts of Madras State led to an enquiry in 1950 by a W.H.O. Team of experts who felt that those periodic epidemics originated from a few villages in the deltaic regions of the Cauvery, Vaigai and Thambaraparni rivers. These served as nuclei for the spread of the disease.

On the basis of the report of this team, the Government of India called for proposals for the control of cholera in these areas. Subsequently, when the National Water Supply and Sanitation Programme was announced, the top-most priority in the selection of beneficiary villages was given to those villages where cholera and other water-borne diseases were prevalent. The Madras State Government selected 379 villages in the districts of South Arcot, Tanjore, Tiruchirappalli, Ramnad and Trinelveli, on the basis of (i) cholera statistics (ii) population (villages with less than 5,000 population being chosen) and (iii) contiguity. The estimated cost of this water supply and sanitation scheme is Rs. 120 lakhs. The population expected to benefit is about 5 lakhs. The cost of water supply and sanitation arrangements has been estimated on per capita basis at Rs. 15 and Rs. 9 respectively. The Government of India is to contribute 50 per cent of the cost and the other 50 per cent is to be found by the State Government. All these schemes were approved during the First Five Year Plan period and are being implemented.

The Committee, therefore, recommends that the eradication programme should be implemented, in the first instance, in West Bengal and Orissa.

- (a) In West Bengal, deducing from the information supplied by the State Health Authorities, the area to be chosen for the eradication drive would be about 500 sq. miles, extending some 10 miles south and 40 miles north of the city of Calcutta. As revealed by the detailed study of cholera in West Bengal, the City of Calcutta forms the major focus of infection. The problem of Calcutta is specific and its tackling requires high priority. The Committee realised that, owing to the magnitude of the task, the total environmental sanitation programme, as envisaged earlier, would require some time for completion. It was understood, however, that, in West Bengal, a beginning has already been made. Some schemes to provide safe water to the industrial areas within the 500 sq. miles zone mentioned above have been implemented in the First and Second Five Year Plan periods (Map 16). The Committee hoped that it would be possible to cover the remaining area during the Third Five Year Plan period.

- (b) In Orissa, the area around Puri and Cuttack will have to be chosen for the eradication programme.

Pending the completion of the recommended measures, the Committee emphasises the need to take such steps now as are feasible to improve the sanitation

in the "bastee" areas, and to conduct mass inoculation campaigns at appropriate intervals to protect the population from cholera.

If all these measures are adopted in the two key areas of West Bengal and Orissa, there is reason to believe that the total picture of cholera in the rest of the country will be materially altered for the better.

## (2) NEED FOR INTERDEPARTMENTAL CO-ORDINATION

As a corollary to the implementation of the recommendations made under (1), it would become necessary to strengthen the Public Health Engineering Organisation in each state and establish a machinery to bring about close co-operation between that organisation and the State Health Directorates. In this connection the relevant resolutions of the Central Council of Health passed at its 7th meeting in Shillong in January, 1959, are reproduced below :-

"That ways and means should be found for integrating the activities of the many agencies concerned particularly in the rural phase of the Programme with a view to developing a co-ordinated programme coming within the purview of the Public Health Engineering Organisation.

"That the Water Supply and Sanitation Programme should be drawn in a way as to cover the requirements of the country within a period of about ten years.

"The Council further reiterates its earlier recommendation that the Public Health Engineering Departments in the States should function as integral parts of the State Public Health Departments."

When the recommendations mentioned above are given effect to, it will be possible to institute water supply and sanitation programmes in areas prone to cholera on a priority basis.

## (3) ESTABLISHMENT OF EPIDEMIOLOGICAL UNITS\*

The epidemiological studies referred to earlier have also brought to light the existence of some foci of infection from which dissemination of the disease in the immediate vicinity as well as, in some cases, distant areas takes place. Such centres are usually places of fairs and festivals. In addition, there might be other centres which also disseminate the disease. Even in the known centres there is need to demarcate more precisely the extent of the foci of infection and to define the relative importance of the different modes of travel in the spread of the disease. It is, therefore, essential to conduct epidemiological studies in different States for this purpose and this can be achieved by the establishment of epidemiological units. The functions of such units will be as follows :-

- (1) To undertake a continuous study of the cholera problem in the State ;

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\*These Units will deal with smallpox also.

- (2) to determine specific areas in each State from which the infection spreads to surrounding areas ;
- (3) to study the role of fairs and festivals in the State in the spread of infection ;
- (4) to study the role of different modes of transport, e.g., road, rail and river, in the spread of infection from the infected foci to other areas in the State ;
- (5) to develop suitable techniques for the early recognition of cases ; and
- (6) to make periodical reports to the centre and the neighbouring States and to alert them when the infection is first introduced in the State.

To perform these functions effectively, each unit should have on its staff :—

One Epidemiologist, preferably with a D.P.H. qualification.

One Statistician.

One Bacteriologist, with a mobile laboratory.

Two Technicians.

One Clerk.

Ancillary Personnel.

The staff requirements of each unit will have to be determined in relation to conditions existing in each State. It is essential that the staff of such units is not assigned any other work, and devotes all the time to the studies on the lines indicated above.

When information on the points mentioned earlier has been collected by these units, it will be possible to take appropriate measures, paying special attention to areas where intensive measures in respect of environmental sanitation are essential. These studies will also provide information of the utmost value to the public health engineering departments and enable them to give high priority to their programmes.

#### (4) CONTROL MEASURES IN EPIDEMIC AREAS

(a) *Legal provisions for ensuring prompt action in fighting epidemics of Cholera*—  
From a general discussion on this subject it was apparent that legal provisions do exist in all the States for use when required. Some considered those provisions to be ample, but it was felt by most that there should be a legal provision on an all-India basis, which should be applicable uniformly, with such changes as the local conditions of the States may necessitate. It was pointed out that the Central Council of Health has been seized of this matter for the last five years and has sent out a Model Public Health Act to the States for examination. The States have been requested to scrutinize the various provisions of the Model Act and get it passed by their respective legislatures after making modifications considered necessary to suit local conditions. It was the view that the Infectious Diseases Control Act, under

consideration by the Union Government, should be promulgated, more or less on the lines of the Central Food Adulteration Act, to ensure uniform procedures all over the country in respect of cholera. The Central Infectious Diseases Control Act was considered particularly desirable because the existing Epidemic Diseases Act did not operate between States.

The Committee accordingly recommends that a Central Infectious Diseases Control Act\* should be promulgated, more or less on the lines of the Central Food Adulteration Act, to ensure uniform procedures all over the country in respect of control of cholera.

(b) *Early detection and notification of cases of cholera*—The *sine qua non* for the successful combating of outbreaks of infectious diseases is early recognition of cases and immediate notification to the health authorities concerned. Early reporting, to be reliable and expeditious, requires to be entrusted to persons fully conversant with the responsibility attached to that duty and duly aware of the importance of timely action in the interest of the community.

The present system of notification appears to be unsatisfactory and its imperfections are many. Either the individual responsible for notifying a case is casual in the discharge of his duty, or he is not familiar with the cardinal symptoms of the disease to enable him to make an approximately correct diagnosis, or the channel through which he has to send this necessary information is so devious that the essential object of getting the information without delay to reach the appropriate health authorities for timely action is defeated. The following few illustrations will highlight the defects enumerated above.

It is stated that in Bombay State "one of the main reasons for the rapid spread of infection is delay in reporting outbreaks of cholera. Illiterate village Headmen not infrequently fail to report outbreaks of cholera until there is a death". In Uttar Pradesh, the reporting of cases is said to be very defective and "primary outbreaks are reported often after the infection has already spread considerably". Information from Andhra Pradesh is to the effect that "cholera epidemics spread to several villages due to late receipt of report from village officials". The large number of cases "reveal the havoc caused by late receipt of first report of cholera from village officials or no report at all from them". In respect of Bihar it is understood that the report of occurrence of cases reaches the health authorities only after a large number of villages are affected. The village Chowkidars in Bihar are required to report epidemics to the Thana officers. "This system is not working well". In respect of the Punjab it is stated that "in rural areas the occurrences (cases of cholera) are reported under Rule 23 of the Chowkidara Rules by the village Headmen and Watchmen to the Station House Officers of the police stations concerned, who, in turn, inform the Superintendent of Police and the District Medical Officer of Health of their respective districts. Information sent through this channel reaches the office of the District Medical Officer of Health very late".

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\*This Act would deal with smallpox also.

The examples quoted above typify the defective and dilatory procedure now existing in the various States in respect of detection and notification of cases of infectious diseases.

During the discussion of this subject, various suggestions were made in regard to the organization of a system whereby early recognition of cases becomes possible and reporting prompt. One view was that the Secretaries of the Gram Panchayats, who are paid officials, should be made responsible for transmitting information to the health authorities. It was stated that, if adequate use is made of the village worker, he can certainly be trusted to send early and correct information of occurrence of cases to the health authorities, especially as the village workers are constantly in touch with the public and, therefore, would get to know of the occurrence of cases at the earliest moment. Another suggestion was that some reward should be given to the man or the village Chowkidar who gives first-hand information about cases. In order to hasten the arrival of information at the office of the District Medical Officer of Health, it was suggested that printed and stamped post cards should be supplied to all the Patwaris in the district. The Patwaris would then send the information about the outbreaks of cholera in their respective circles on these cards direct to the office of the District Medical Officer of Health. This system, apparently, has been working well in one State and has been found helpful to some extent. Yet another suggestion was that the Collector of the District should be empowered to take very strict action against the village officials who delay sending in information of cases to the appropriate authorities and that deterrent punishment for those who fail to report occurrence of cases in time should have the sanction of law. The importance of educative propaganda, by means of talks, posters, pamphlets, etc., carried out in composite areas for educating all village officers to ensure prompt and correct reporting, was stressed. Rewards, in the form of cash or merit certificates, were also recommended for those who perform their duties without avoidable delay.

The Committee, cognisant of the importance of early recognition and notification of cases and taking into account the views expressed, recommends : (i) that whenever an epidemic of gastro-enteritis assumes the clinical picture of cholera, it should be reported as cholera for administrative purposes, and the use of the word 'gastro-enteritis', which has been adopted in one State, should, as far as possible, be avoided, unless there is ample evidence from a recognised laboratory to the effect that it is undeniably gastro-enteritis and not cholera ; (ii) that it is desirable to place the responsibility of notification on the Panchayats, because the Chowkidar or the Gram Sevak or the Village Headman will all be presumably under the control of the Panchayat ; (iii) that the Panchayat Secretary should transmit the information to health authorities by telegram, if a telegraph office is within easy reach, otherwise by a special messenger, and the doctor in charge of the Primary Health Centre or the Sanitary Inspector and the District Medical Officer of Health should be informed by him simultaneously ; and (iv) that it is necessary to have special instructions

prepared for the guidance of chowkidars and others to help them recognise cases and which should also highlight the necessity of reporting cases without delay.

(c) *Isolation and treatment of cases*—Adequate facilities for isolation of frank cases of cholera do not exist in many States, as stated earlier. Isolation of cases is essential for two purposes—(a) for ensuring prompt treatment and thus reducing mortality and (b) for preventing further spread of the infection. From the experience gained so far, it would appear that mobile hospitals of the type now functioning in Bombay State to which reference has been made, or similar hospitals proposed to be established by other States, would serve the needs of the situation.

The Committee, therefore, recommends that (i) mobile hospitals, with adequate personnel and equipment, should be established in each State for the rural areas and (ii) special isolation wards should be created in district and taluk hospitals to serve the needs of the urban areas.

(d) *Use of sulphaguanidine in preventing the spread of infection*—It has been found that the administration of sulphaguanidine causes the destruction of cholera vibrios in the intestine and the patient ceases to excrete them in about 48 hours or so. Advantage may be taken of this observation and sulphaguanidine therapy utilised in arresting the spread of infection.

The Committee, therefore, recommends that medicine chests, with adequate supplies of sulphaguanidine, should be provided in villages prone to epidemics of cholera and in other areas threatened with outbreaks of the disease in order to facilitate immediate treatment pending the arrival of mobile hospitals.

(e) *Technical aspects of cholera vaccine prophylaxis*

(i) *Efficacy of vaccine*—Experience gained in the past several years has amply demonstrated the efficacy of cholera vaccine in the control of epidemics. It must, however, be remembered that the duration of immunity conferred by the vaccine is short-lived, that effective immunity lasts for about six months, at any rate not longer than one year, and that it does not influence in any way the mortality rate, should the vaccinated individuals develop the disease. Even so, there is enough evidence to show that the cholera vaccine currently in use does confer adequate protection when used either before the onset of an epidemic or in mass inoculation campaigns after an epidemic has started in an area. This opinion is based on the work of Adishesan, Pandit and Venkataraman\* in Madras, where an assessment of cholera vaccine was made regarding its protective value when utilised in the way it is used by the public health departments in the country, i.e., mostly after the epidemic has broken out in an area. Even in areas where bad hygienic conditions existed, the protective value of the vaccine was found to be statistically significant. As a further evidence of its prophylactic value, it might be stated that some of the major fairs and festivals have ceased to be centres for the dissemination of the infection after the institution of compulsory inoculation of pilgrims attending such festivals.

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\*Adishesan, R., Pandit, C.G., and Venkataraman, K.V. 1947, *Ind. Jour. Med. Res.*, **35**, 131.

Taking all these aspects into consideration, the Committee recommends that regulations for the proper utilisation of vaccine should be drawn up, which could be enforced without delay whenever and wherever required.

(ii) *Strains of cholera vibrios for the production of vaccine*—Cholera epidemics in the country are usually caused by Inaba or Ogawa sub-types of the vibrio. It is essential, therefore, that the vaccine should contain organisms of both kinds. A point is sometimes made that, in view of the initial isolation of one or the other sub-type responsible for a given epidemic, the vaccine for use during that epidemic should be manufactured from the organism found to be responsible for the outbreak. Available evidence, however, shows that the character of the vibrio changes periodically, not only from year to year, but also sometimes during the course of an epidemic itself. In view of this, and since it takes a long time to produce cholera vaccine on a large scale, a bivalent vaccine, containing the two sub-types Inaba and Ogawa in equal proportions, should be the only vaccine for general use in the country.

(iii) *Potency of the vaccine*—The Drugs Act, 1940, has laid down standard procedures for the manufacture and issue of cholera vaccine. However, some tests for its antigenicity, which are elaborate, are not done routinely, especially by laboratories producing agar vaccine. It is realised that it is not always possible for each laboratory to test batches of its own vaccine frequently, especially when the vaccine is to be turned out in large quantities.

The Committee, therefore, recommends that, in order to facilitate manufacture of a standard vaccine, one centre should be established in the country with the following functions :

- (a) Distribution of suitable strains of cholera vibrio to manufacturing centres;
- (b) determination of potency of the vaccine produced by different centres ;  
and
- (c) distribution of diagnostic sera for use by the public health authorities.

The Committee further recommends that, pending the establishment of such a centre on a permanent basis, one of the existing laboratories, which is suitably equipped, should be entrusted with the tasks suggested.

(iv) *Supply, storage and distribution of vaccine*—As stated earlier in the report, cholera vaccine is manufactured at 11 different centres in the country. With the institution of mass inoculation campaigns, it will be necessary to augment the present production capacity of all these centres.

The Committee, therefore, recommends that the States, which do not have facilities for manufacturing vaccine in larger quantities, should take immediate steps to increase production.

For ready availability of vaccine at short notice, the Committee recommends that adequate stocks should be maintained at district headquarters and that there should be subsidiary depots at Thana headquarters. The machinery recommended

for the storage of smallpox vaccine may be utilised for this purpose as well. The Committee realised that such a procedure might sometimes result in wastage of vaccine, but that was considered inevitable. The Administrative Medical Officer or the Director of Health Services of each State should bear the responsibility of co-ordinating procurement and distribution of vaccine within the State.

(v) *Meeting cost of vaccine*—Taking note of the fact that the local health authorities do not always have funds available for the purchase of cholera vaccine when an epidemic threatens, the Committee recommends that the State Governments should accept the responsibility of meeting the cost of vaccine for use within the State and that they should ensure that routine administrative and financial procedures do not hamper the effective and timely utilisation of the vaccine.

(vi) *Dosage of vaccine*—As a standard procedure, the Committee recommends that one dose of 1 c.c. vaccine should be given to adults in all mass vaccination programmes. Immediate vaccination of contacts of cholera is essential in the opinion of the Committee. Children should receive dosage of vaccine according to age.

The recommended measures, if adopted, will facilitate the control of epidemics within a reasonably short time. During the inter-epidemic periods, the Committee recommends that a special programme should be instituted for the vaccination of labour employed in the industrial establishments, both in the public and private sectors, as well as of immigrant labour employed in agricultural and other operations. Vaccination of labour should be repeated once every six months.

(f) *Chlorination of water supplies*—It has to be pointed out at the outset that, in a large scale campaign of disinfection of water sources in general, defects in the construction and maintenance of open wells and tubewells, which are often the main cause of contamination of water, are likely to be lost sight of. There are many instances of tubewells being responsible for introducing contamination when they have had worn-out leather foot valves, or the priming of the pump has been done with water of doubtful quality. The importance of maintenance of water sources in a manner to ensure prevention of pollution can hardly be over emphasised. Attention to this aspect should, therefore, always take precedence over routine disinfection of water with chlorine compounds.

Chlorination is the most efficient, inexpensive, reliable, simple and, above all, safe method of destroying common pathogenic organisms in water. In concentrations generally used in water disinfection, it does not, however, destroy spore-forming organisms, protozoal cysts, helminthic ova and viruses. Large dosage of chlorine and longer period of contact are required to destroy molluscs and cercariæ.

Chlorine is an oxidising agent. Its germicidal action will depend on the amount of organic matter present in the water to be treated. Disinfection with chlorine is more effective in acidic waters than in alkaline waters. Free chlorine is much more effective in germicidal action than combined chlorine in the form of chloramines. The latter can serve as a disinfectant if the contact period is increased.



Chlorination is not a substitute for efficient filtration when turbid waters have to be treated. Similarly, it is not a substitute for the biological action of sand filters and sedimentation tanks while dealing with gross pollution. Water with a very high bacterial load is not efficiently disinfected by chlorination. Same is the case with water rich in organic matter or reducing chemicals. Such water sources have a high and variable chlorine demand.

In cities with proper waterworks, water is supplied after suitable filtration and chlorination. Chlorine in the form of gas is used with the help of an automatic chlorinating plant, called chloronome. This method may not be feasible in small towns and rural areas.

Bleaching powder is used mostly for disinfection of rural water supplies. It is an unstable chemical and the amount of chlorine available in it is reduced by several factors, such as, moisture, carbon dioxide, heat, light and possibly the mechanical shaking it receives during packing, transportation and handling. 'Stabilized bleach' or 'water sterilizing powder', containing 80% bleaching powder and 20 per cent quicklime and supplied in polythene bags of convenient size, is said to have better keeping qualities. On account of added quicklime, its chlorine content is proportionately reduced from 33 to about 25 per cent. Under proper storage conditions, however, its available chlorine content is not expected to fall below 20 per cent in the course of an year. The use of 'stabilized bleach', therefore, is recommended instead of the highly unstable bleaching powder.

Before starting the disinfection of water supply with bleaching powder, it is desirable to find out the amount of available chlorine in the bleach in the first instance, and, ascertain the chlorine demand of water to be treated. The residual chlorine in the treated water after a contact period of half an hour should then be ascertained. A residue of free chlorine is better than that of combined chlorine (chloramines). It may not, however, be convenient to arrange for these tests under field conditions. The simplest way, therefore, is to stock only high-grade quality bleaching powder under good conditions of storage and to use it properly. Addition of chlorine in excess leaves a bad taste in the water and people are naturally averse to using such water. Superchlorination followed by dechlorination is costly and tedious. It is practised in individual cases by the Army under field conditions. Marginal chlorination, with a fixed dose of 2 parts per million of chlorine and with a contact period of about half an hour, is found to give the best results in the field, where grossly polluted water may have to be disinfected. This dose is likely to leave 0.3 ppm of residual chlorine, free or combined.

The empirical procedure of disinfection is, however, exposed to the risk of proving either insufficient or excessive, especially because of the variable chlorine demand of different water supplies. It is, therefore, desirable that, wherever possible, the chlorine demand should be determined on the spot, at least in the case of grossly polluted water of wells, tanks and dobas, and the required quantity of

bleaching powder worked out in each case. It should be possible to provide the field staff, responsible for supply of potable and safe water, with Horrock's outfits as modified by the All-India Institute of Hygiene and Public Health, the use of which is simple and convenient in the field. The method of use of these outfits for the determination of chlorine requirement of any water supply is described in Appendix II.

The amount of bleaching powder required to disinfect one gallon of water with 2 ppm of chlorine can easily be determined by the following simple formula:—

Bleach in grains =  $\frac{14}{X}$  per gallon, where X is the percentage chlorine content of the bleach. A bleach with 20 per cent chlorine content will require 70 grains for 100 gallons, 350 grains for 500 gallons, and 700 grains for 1000 gallons of water. It may be noted, however, that, in the disinfection of surface water like that of tanks, lakes, etc., chlorination dose should not ordinarily exceed 2 ppm of chlorine in view of the fact that fishes are very susceptible to free chlorine, their tolerance limit being in the neighbourhood of 2-3 ppm.

It is advantageous to test the treated water for its residual chlorine content after half an hour. This can be done with the help of potassium iodide solution and starch paper. The latter, in the presence of residual potassium iodide, turns blue when a couple of drops of treated water are placed on it. Freshly prepared solutions of potassium iodide and starch for this test are preferable. Orthotoluidine test is more sensitive and determines the residual chlorine at as low a level as 0.1 ppm. As such, this should be the test of choice. Ten drops of this reagent are added to about 10 c. c. of treated water in a test tube. Development of a yellow colour within 5 second indicates the presence of free chlorine and the same colour developing within 5 minutes indicates the presence of combined chlorine.

For disinfection of well water, the capacity of the well in gallons can be estimated by the simple formula,  $5D^2H$ , where D indicates the diameter of the well in feet and H the depth in feet of water in the well. The required amount of bleaching powder of the quality available is determined by the formula mentioned earlier. This calculated quantity of bleach is then mixed with water in a bituminized bucket. Chlorine is highly soluble in water and gets dissolved readily. Small lumps of the bleach do not require breaking. Excessive shaking should be avoided. What remains in suspension is lime. The contents of the bucket are emptied into the well and the water in it is thoroughly agitated by lowering the bucket about two feet below the water level and giving jerky movements to the rope tied to the bucket.

Residual chlorine in the treated well water may be tested after half an hour by the starch and potassium iodide or the orthotoluidine tests. More bleaching powder will have to be added if the test gives negative result. Residual chlorine will get reduced in course of time, depending upon the degree to which the well is put in use. In the absence of rigorously regulated continuous chlorination, safety

of well water between two bleachings cannot be assured. However, the risk may not be great, since the ground water seeping into the well to replace the drawn water is usually free from gross contamination.

Disinfection of tubewells should be resorted to only in unavoidable cases where evidence of pollution persists even after pumping out the water adequately. A method for the disinfection of the tubewells is described in Appendix III.

Disinfection of a large collection of surface water by chlorine or any other disinfectant cannot be achieved efficiently. The best way is to collect the required amount of water in a tank, cistern or reservoir and chlorinate it with the calculated dose of bleach. Adding bleaching powder to large tanks, lakes, or streams, at water drawing points, may be tried. But it cannot be called a reliable method as the dose of bleach cannot be accurately determined. The following may serve as a guide in chlorination of surface waters, running or stagnant.

For tanks and lakes with an average depth of five feet, about 15 pounds of bleaching powder will be required per acre, or one pound per 3,000 sq. ft. In many cases, disinfection of water near the banks is considered adequate. For this purpose, one ounce of bleaching powder per five running feet of water is used. Chlorination is done by moving just under the surface of water a cloth bag containing the required amount of bleach.

It may be necessary to adopt disinfection of small streams as a measure of expediency during cholera epidemics. A dose of one pound per 80 running feet (one ounce per 5 running feet) should be used. The chemical, placed in a cloth bag, is allowed to dissolve in the running water at a point higher up in the course of the stream.

It is difficult to arrange for rigorous and continuous chlorination of rural water supplies. Intermittent disinfection at short intervals is the usual practice. During an epidemic or threatened epidemic of cholera, continuous chlorination should be resorted to, particularly at large temporary fairs. Daily disinfection of rural water supply is necessary if the source is suspicious or subject to contamination. Safe water must be made available continuously, if possible. Well water supplies do not require too frequent disinfection, if the well mouth is fully protected and the well is used with proper sanitary precautions. During epidemics, the use of surface water should be discontinued and alternative sources, such as properly protected wells, should be utilized. If this is not possible, surface water from fully protected and secured points should be obtained and supplied after proper disinfection in suitable reservoirs.

(g) *Disinfection of cholera discharges and fomites.*

(i) *General*—The causative organisms of cholera are passed by the patient in stools and vomit and these soil the bed linen and other articles in use by the patient. Flies carry infection to food, so it is necessary to see that flies do not find access to the patients' stools, vomit and other articles soiled by them. Smell of

chlorine keeps flies away. As such, bleaching powder may be sprinkled all round as well as over the discharges. Failing that, lime, hot ashes, or even clean earth should be placed over the discharges till proper concurrent or terminal disinfection is arranged. Meanwhile, all flies in the room or its vicinity may be caught by using fly paper which may be placed near and over the soiled articles or discharges and destroyed after it has served the purpose. Bleaching powder as well as fly-paper may be used in the ambulance or the vehicle used for carrying the patient to the hospital with a view to controlling the infection through flies during transit.

The most effective disinfectant for general use by the attendants on cholera cases is a coal-tar derivative containing cresols and phenols. A cresolic disinfectant, with a high Rideal-Walker (R.W.) coefficient of 10 or more, should preferably be used. If that is not available, one with R.W. coefficient of 5 or more may be used in appropriate strength. A disinfectant with a R.W. value of less than 5 should not be used. It is convenient if most of the disinfection work in the field is carried out by a single disinfectant, with minimum changes in dilutions. For general use,  $1\frac{1}{2}$  ounces per gallon (one per cent) of a cresolic disinfectant of R.W. value of 10, or 3 ounces per gallon (two per cent) of a disinfectant with 5 R.W. value would be satisfactory. In this dilution, it is not dangerously toxic to man if accidentally swallowed, is only mildly irritant to the skin, and possesses satisfactory germicidal power. But, for efficient disinfection of *linen, bed-pans and discharges*, the common strength used is four ounces per gallon of a disinfectant ( $2\frac{1}{2}$  per cent) of a R.W. value of 10, or 8 ounces per gallon of a disinfectant of the R.W. value of 5. Even at this concentration, fabrics are not damaged. The cresolic disinfectant used for this purpose should not only have high germicidal value but should also conform to the standard specifications. Double strength disinfectant is often used for liquid cholera discharges to maintain the required germicidal strength.

(ii) *Clothing and bedding*—Such articles as are of no value can be burnt. Bed linen, blankets, etc., which have been contaminated with infectious discharges such as vomit or excreta, should be steeped in  $2\frac{1}{2}$  per cent cresol for half an hour and then washed with soap and hot water. Boiling of bulky bedding may be difficult, but clothing, towels, handkerchiefs, etc. can be boiled in a pan.

(iii) *Floor and walls of huts*—Floor must be thoroughly cleaned with 5 per cent cresol. Walls upto a height of at least 3 feet from the floor should be treated similarly. Mud or thatch walls may be soaked with the disinfectant. Infected articles lying on the floor, such as bed pans, urine bottles, soiled clothing, etc. should be protected from flies by covering them with a sheet of cloth soaked in cresol solution.

(iv) *Stools and vomit*—These should preferably be burnt. This can be done by having a fire in the open into which the liquid discharges can be dropped in small quantities at a time, taking care to see that the fire is not put out. If this is not possible, then the excreta can be buried, preferably after disinfection with equal quantity of 5 per cent cresol. Bleaching powder or quicklime emulsions in

water can also be used. If there is no danger of fire, the floor contaminated with liquid stool or vomit can be disinfected by burning fire over the soiled area.

(v) *Privies and drains*—Scrubbing with 2½ per cent cresol will disinfect them.

(vi) *Feeding and cooking utensils*—Boiling these in water for 15 minutes, or steeping them in cresol solution and then washing them with water and soda would disinfect them.

(vii) *Vehicles, beds, furnitures, etc.*—These should be scrubbed with 2½ per cent cresol.

(viii) *Articles not actually soiled, but used by a patient*—Putting them out in the hot sun may be tried, if boiling is not possible. Hot ironing of mattresses, blankets, pillows, etc., is also satisfactory, provided it is done properly.

(ix) *Hands*—Those attending on a case should dip their hands in bleaching powder solution or in one per cent cresol solution and wash them afterwards with soap and water.

In hospitals there should be arrangement for steam disinfection of soiled bedding, clothing, etc. Where that is not available, other kinds of disinfection described above may be resorted to.

#### (5) FORMATION OF ANTI-EPIDEMIC COMMITTEES AT THE DISTRICT LEVEL

The Committee was informed that, at the annual Conference on Community Development held at Mount Abu in April, 1958, a unanimous decision was made to recommend the establishment of District Anti-epidemic Committees in each State to help the authorities in the control of Smallpox and Cholera. The conference was of the opinion that such Committees should include the District Health Officer, representatives of the Education and Development Departments of the State, members of the Assembly and the Council, and representatives of women's and other voluntary organisations.

The objectives of such Committees would be to help in the control of the disease with measures such as the improvement of environmental sanitation, efficient organisation of inoculation campaigns against cholera and, as in order to achieve these objects it would be necessary to obtain the willing co-operation of the people, the enlistment of the active co-operation of the peoples representatives in the control measures. Field workers of the Community Development Programme are specially trained in the methodology of approach to the people to secure their co-operation and their experience in this regard would require to be utilised.

The District Anti-epidemic Committee should work in close co-operation with the Epidemiological Unit recommended to be established at the State level.

The Committee unanimously supported the idea of the formation of District Anti-epidemic Committees and considered them essential in the overall drive against the disease.

## (6) HEALTH EDUCATION

The question of health education was considered in great detail. It was felt that, unless the population is made fully alive to what is being attempted and why, the whole eradication programme would be greatly handicapped. It was the general view that, while the methodology of the mass campaign against cholera is being worked out, opportunities should be taken to impart health education on a broad basis without loss of time. The utilisation of diverse means, such as films, filmstrips, advertisements, the press, the radio, 'bhajjan' parties, public meetings and exhibitions, was considered appropriate in order to instil in the minds of the people the necessity of co-operating whole-heartedly in the eradication programme. Production of health education films, it was felt, should receive top priority in the programme of the Films Division of the Government of India.

In respect of films, some very useful suggestions were made. Important amongst those were that : the films should not only be educative but also interesting ; in these films the emphasis should be on DOs and not on DONTs ; they should be in the local language ; there should be a properly planned sequence in the story depicted in the films ; special attention should be paid while producing the film to see that the religious sentiments of the people are not ridiculed in any way ; no attempt should be made to show awe-inspiring or panic-creating scenes ; the films should be such that they impress the women folk and children, as it was felt that that group of population needs intensive indoctrination in the principles of health education in order to enthuse them, and, through them, the male adult population, with the value of imbibing that useful knowledge.

It was considered best that the health education programme should be planned in consultation with some expert advertising agency or publicity organisation and that the films and slides should be shown daily in cinema houses along with the day's scheduled picture and documentary film.

It was suggested that the films should not be shown in isolation but that they should be preceded and followed by light entertaining films. Such a procedure, it was felt, would sustain the interest of the audience in the health educative film.

The Committee, therefore, recommends that preparations for health education, as indicated above, should be taken in hand as soon as the principle of the eradication programme is accepted and education of the population carried out with increasing tempo so that the people are fully ready to receive the programme when it is launched.

## (7) PILOT PROJECTS

In the control and ultimate eradication of cholera, institution of all the measures recommended above, such as provision of protected water supplies, chlorination of water sources, sanitary disposal of excreta, vaccine prophylaxis, mobile

hospital service with Central assistance if necessary, will all be necessary. In order to arrive at a fairly comprehensive estimate of the requirements in respect of funds and manpower, the Committee recommends that each State, where cholera is at present a major public health problem, should institute a pilot project in a selected area prone to frequent epidemics of cholera.

#### (8) NEED FOR FURTHER RESEARCH

For the eradication of any communicable disease, adequate knowledge of its precise etiology and epidemiology, as well as efficient arrangements for proper diagnosis and treatment are essential. For several years, the Indian Research Fund Association, now called the Indian Council of Medical Research, has encouraged studies on the problem of cholera. In earlier years, attention was paid primarily to the study of the causative organism. As a result of this, it has been possible to isolate the true cholera vibrio from amongst several morphologically similar organisms often found associated with epidemics of cholera and gastro-enteritis. This study is considered to be of basic importance as it has led to further progress in investigations on other aspects of the disease, including its epidemiology and the conditions under which the infection is transmitted to man. The knowledge of the true nature of the vibrio has paved the way for the manufacture of a suitable prophylactic vaccine. The studies have also provided the basis for instituting appropriate quarantine regulations. But there are still several basic aspects of the problem of cholera which require to be elucidated. For example, it is recognised that cholera breaks out *de novo* in some areas, and yet the manner in which the infection persists in such areas during inter-epidemic periods is not fully understood. Extensive investigations conducted in the Khulna district of pre-partition Bengal and the Cauvery delta in the South failed to throw light on this important aspect. The sum total of the experience gained during these investigations is that cholera vibrios appear in the environment only when there are cases about. Again, in spite of repeated attempts, no significant advance has taken place in the treatment of cholera since the introduction of hypertonic saline therapy by Rogers in the management of suitable cases. The newly discovered chemotherapeutic drugs and antibiotics have not been found useful as specifics in the treatment of a case, although sulpha drugs are helpful in destroying the cholera organisms in the bowel and thus incidentally reducing the infectivity of the case.

It is thus obvious that there is need for further research into many facets of the problem of cholera. The epidemiological units already recommended by the Committee will no doubt throw light on some of the problems listed above. Their work will embrace research in the field. Here specific mention is being made of the need for further laboratory research. This question has been engaging the attention of the Cholera Advisory Committee of the Indian Council of Medical Research which has recommended the establishment of a permanent unit, with full-time staff, for the purpose of continuing research on this vexing problem. It is

considered essential that this recommendation is given effect to immediately. Some of the items of work, to which a unit of this nature would devote time, would be :—

- (a) A complete investigation of cases of cholera and gastro-enteritis from clinical, bacteriological, immunological, metabolic and biochemical aspects.
- (b) Evolving practical methods for assessing immunity levels in population groups.
- (c) Investigation of the role of intestinal viruses as predisposing factors in the causation of cholera.
- (d) Determination of the role, if any, of cholera-like vibrios in the pathogenesis of the disease in different parts of the country.
- (e) Determination of the utility of tissue culture techniques in studies on cholera.
- (f) Attempts at transmission of infection to laboratory animals to facilitate studies visualised above.
- (g) Attempts at improvement of the present cholera vaccine with a view to increasing the duration of immunity conferred by it.

In view of the ready availability of material, the Committee recommends that such a unit be established in Calcutta.

#### (9) CENTRAL SMALLPOX AND CHOLERA CONTROL COMMISSION\*

In the execution of the programme for the control and eradication of cholera, on the lines indicated in the report, it would be necessary to establish a suitable machinery for co-ordinating the activities of the participating States in this connection. The Committee, therefore, recommends that the Government of India should constitute a Central Smallpox and Cholera Control Commission, consisting of members appointed on a full-time basis. The task of the Commission would be :—

- (a) To ensure that the approved programme is carried out according to plan and to administer the funds placed at its disposal ;
- (b) to act as a central advisory board for the execution of the programme ;
- (c) to co-ordinate the activities of the States in this field ;
- (d) to assess periodically the progress made ;
- (e) to serve as a clearing house of information, including that obtained by the different epidemiological units, for the Union and the State Ministries of Health, and
- (f) to undertake all such other tasks as may require to be performed in the interest of the eradication programme.

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\*As this Commission will function in respect of Cholera as well as Smallpox, both the diseases are included in its name and its composition is so arranged that it can deal with both the diseases.



The Committee further recommends that the Central Commission should consist of :—

- (1) Five Medical Members.
- (2) One Statistician.
- (3) One Public Health Engineer.
- (4) One Financial Adviser.
- (5) Ancillary staff.

Out of the five medical members, one should be the Chairman, one Member-Secretary and the remaining three to serve as zonal representatives of the Commission. All of them should be conversant with the problems involved in the control and eradication of the two diseases and one of them should preferably be an epidemiologist.

The public health engineer is to render advice and guidance in respect of environmental sanitation programmes in the control of cholera.

The three medical members to serve as zonal representatives should have adequate experience in public health administration to be able to co-ordinate the work of the States comprising their respective zones in connection with the proposed programme.

The composition of the zones should be as under :—

One zone should include West Bengal, Bihar, Uttar Pradesh, Punjab and Assam.

The second zone should include Orissa, Madhya Pradesh, Rajasthan and Bombay.

The third zone should include Andhra Pradesh, Mysore, Madras and Kerala.

The zonal grouping is based on the characteristic epidemiological features of cholera in the territories so grouped and would be suitable from the points of view of accessibility and administrative convenience to the zonal representatives, thus enabling them to function effectively.

The Committee further recommends that each State should nominate one senior officer of its health department to be in full-time charge of the eradication operations in the State. This officer will have to co-ordinate the activities of the district epidemic committees. He will also have to work in close co-operation with the zonal representatives of the Commission.

## VI. ESTIMATE OF COSTS INVOLVED IN IMPLEMENTING THE RECOMMENDATIONS

The Committee understood that, in the Second Five Year Plan, Rs. 63 crores have been provided for urban water supply and sewerage schemes and Rs. 28 crores for rural water supply and sanitary projects. If concerted and fruitful efforts are to be made to control and ultimately eradicate cholera, it would be necessary to allot

much larger funds for water supply schemes. The Committee was strongly of the view that, in determining priorities for the execution of the schemes, the criteria laid down by the Government of India should be strictly adhered to.

An approximate estimate of costs, together with the *raison d'être* for their calculation, is given below :—

(A) COST OF CHOLERA ERADICATION FROM CERTAIN KEY AREAS OF ENDEMICITY

**1. West Bengal**

Out of an area of about 500 sq. miles considered necessary to launch the eradication drive in, intensive coverage will be needed in about 390 sq. miles, which constitute the urban area of greater Calcutta. Calcutta and Howrah, which together form the major focus of infection, have to be treated separately but simultaneously. The Corporation of Calcutta has a plan for supplying protected water to an anticipated optimum population of 4 million at a total cost of Rs. 12.57 crores. A part of the scheme costing Rs. 205 lakhs has already been taken up for execution during the Second Plan period. For the eradication drive, the urban and semi-urban populations, excluding that of Calcutta city, requiring to be served immediately, may be estimated roughly at 3 million. For planning purposes, however, the total population of greater Calcutta should be taken as 8 million, allowing for normal growth. The rural population to be covered in the remaining area of 110 sq. miles may not exceed a quarter million. Calculating the cost for water supplies on the basis of Rs. 50/- per capita in urban areas and Rs. 20/- per capita in rural areas, a total provision of Rs. 40.5 crores would be needed for the purpose. However, it is understood that some expenditure has already been incurred in this regard in the First and Second Five Year Plan periods. It is estimated that a provision of Rs. 20 crores would require to be made now to cover the entire area recommended by the Committee. Separate provision for sewerage in urban and semi-urban areas would be necessary. The details of expenditure will have to be worked out later, and the programme will have to be phased according to availability of funds and facilities for obtaining materials and equipment. It must be emphasised, however, that the expenditure on this account is inescapable, even if the eradication programme is not taken up immediately, as the provision of safe water is of the utmost importance in any case.

**2. Orissa**

Here, an area of about 100 sq. miles around Puri will have to be taken for the cholera eradication programme. In addition to Puri town proper, the surrounding area, with a population of about 66,000, will have to be provided with protected water supply and sewerage. The cost of providing these in the area excluding Puri will be about Rs. 13.2 lakhs and separate provision will be necessary for Puri town.

## (B) COST OF MEASURES TO PREVENT OCCURRENCE OF CHOLERA AT PILGRIM CENTRES

Financial provision for arranging safe water supplies at pilgrim centres in epidemic areas is necessary, but the Committee is not in a position to make any specific recommendations in this regard. The areas involved will have to be delineated after epidemiological surveys, for which the Committee has recommended the establishment of Epidemiological Units in each State.

The Committee considered it necessary that, in addition to the provision of safe water at pilgrim centres, arrangements should be made for supplying safe water at convenient spots along the routes taken by the pilgrims to reach and return from such centres. Here again, the Epidemiological Units will be able to provide the necessary information.

## (C) COST ON THE ESTABLISHMENT OF EPIDEMIOLOGICAL UNITS

The general staff structure of an Epidemiological Unit recommended to be established in each State has been discussed earlier in this report. At the pay scales admissible to Central Government servants at present, the expenditure on salaries of staff and on contingencies will be approximately Rs. 40,000 per annum. In addition, provision will have to be made for a jeep-station-wagon and equipment for a mobile laboratory at an approximate cost of Rs. 20,000.

(D) COST OF A MOBILE HOSPITAL FOR ISOLATION AND TREATMENT  
OF CASES OF CHOLERA

The cost of equipping and maintaining a mobile 50-bedded hospital, on the pattern developed by Bombay State, would approximately be as follows :—

Non-recurring expenditure	...	...	Rs. 1 lakh
Recurring expenditure	...	...	Rs. 1 lakh per annum

## (E) COST OF STORAGE AND DISTRIBUTION OF CHOLERA VACCINE

The Committee has recommended that the facilities to be provided for the storage and distribution of smallpox vaccine in connection with the smallpox eradication programme should be utilised for cholera vaccine also, both at districts and subsidiary storage depots. The total cost of providing refrigerators, etc. would be about Rs. 30 lakhs. No separate budget provision for cholera control programme is, therefore, necessary.

## (F) COST OF HEALTH EDUCATION

The same remarks as were made in regard to health education in connection with smallpox apply to the programme of health education in respect of cholera. One health education campaign can serve to disseminate knowledge about both the diseases. Provision of Rs. 10 lakhs has already been suggested under Smallpox for

making films, posters, etc. No separate provision for cholera programme is, therefore, necessary.

#### (G) COST OF CHOLERA VACCINE

The cost of an additional 100 million doses of cholera vaccine would be about Rs. 6.25 millions.

#### (H) COST OF PILOT PROJECT

The Committee is unable to make any specific recommendation in regard to cost of pilot projects, as many local factors would determine the expenditure on a pilot project in any given State.

#### (I) COST OF RESEARCH

For the establishment of a cholera research centre on a permanent basis, as recommended by the Committee earlier an overall provision of Rs. 1 lakh per year is suggested. It is assumed that the unit will be accommodated in one of the existing institutions in Calcutta city.

It will be noticed that no attempt has been made to suggest any particular basis for allocation of expenditure on the eradication programme between the Central and State Governments. A general pattern of assistance in environmental sanitation programmes has been worked out already and the Central Government could decide, in consultation with the States, the extent to which that pattern with agreed modifications could be adopted in respect of smallpox and cholera eradication programme to ensure smooth and immediate action on the recommendation of the Committee.

### VII. ABSTRACT OF RECOMMENDATIONS

#### (1) NEED FOR CONCERTED EFFORTS FOR CHOLERA CONTROL IN CERTAIN KEY AREAS OF ENDEMICITY

The Committee recommends that the eradication programme should be implemented in West Bengal and Orissa in the first instance.

(a) In West Bengal, the area to be chosen for the eradication programme would be about 500 sq. miles, extending some 10 miles south and 40 miles north of the city of Calcutta. The city forms the major focus of infection, and its problem is specific and requires to be tackled on a high priority basis.

(b) In Orissa, the eradication programme should be carried out in the area around Puri and Cuttack.

There is reason to believe that the total picture of cholera in the rest of the country would be materially altered for the better, if measures recommended above are taken in those two key areas.

## (2) NEED FOR INTERDEPARTMENTAL CO-ORDINATION

The Committee recommends the strengthening of the Public Health Engineering Organisation in each State and establishment of a machinery to bring about close co-operation between that organisation and the State Health Directorate. The Committee further recommends that the resolutions passed by the Central Council of Health at its 7th meeting in Shillong in January, 1959, should be implemented.

## (3) ESTABLISHMENT OF EPIDEMIOLOGICAL UNITS

The Committee recommends that epidemiological studies should be carried out in the States by these Units to elucidate the factor or factors responsible for the spread of the epidemic within the State and to other States and to perform the other functions recommended earlier in the report.

## (4) CONTROL MEASURES IN EPIDEMIC AREAS

(a) *Legal provisions for ensuring prompt action in fighting epidemics of cholera*—The Committee recommends that a Central Infectious Diseases Control Act should be promulgated, more or less on the lines of the Central Food Adulteration Act, to ensure adoption of uniform procedures all over the country in respect of control of cholera.

(b) *Early detection and notification of cases of cholera*—The Committee recommends that:—

- (i) Whenever an epidemic of gastro-enteritis assumes the clinical picture of cholera, it should be reported as cholera for administrative purposes, and the use of the word 'gastro-enteritis', which has been adopted in one State, should, as far as possible, be avoided, unless there is ample evidence from a recognised laboratory to the effect that it is undeniably gastro-enteritis and not cholera ;
- (ii) responsibility of notification should be placed on the Panchayats, because the Chowkidar or the Gram Sewak or the village Headman will all be presumably under the Control of the Panchayat ;
- (iii) the Panchayat Secretary should transmit the information to health authorities by telegram if a telegraph office is within easy reach, otherwise by a special messenger, and the doctor in charge of the Primary Health Centre or the Sanitary Inspectors and the District Medical Officer of Health should be informed by him simultaneously ;
- (iv) special instructions should be prepared for the guidance of chowkidars and others to help them recognise cases and which should also highlight the necessity of reporting cases without delay.

(c) *Isolation and treatment of cases*—The Committee recommends that :—

- (i) Mobile hospitals with adequate personnel and equipment should be established in each State for the rural areas ; and
- (ii) special isolation wards should be created in district and taluk hospitals to serve the needs of the urban areas.

(d) *Use of sulphaguanidine in preventing the spread of infection*—The Committee recommends that medicine chests with adequate supplies of sulphaguanidine should be provided in villages prone to epidemics of cholera and in other areas threatened with outbreaks of the disease in order to facilitate immediate treatment pending the arrival of mobile hospitals.

(e) *Technical aspects of cholera vaccine prophylaxis*

- (i) *Efficacy of vaccine*—The Committee recommends that regulations for the proper utilisation of vaccine, which could be enforced without delay whenever and wherever required, should be drawn up.
- (ii) *Strains of cholera vibrio for the production of vaccine*—The Committee recommends that the vaccine for use during epidemics should be manufactured from both the Inaba and Ogawa strains of cholera vibrio in equal proportion.
- (iii) *Potency of the vaccine*—The Committee recommends that, in order to facilitate manufacture of a standard vaccine, one centre should be established in the country with the following functions :—
  - (a) Distribution of suitable strains of cholera vibrio to manufacturing centres ;
  - (b) determination of potency of the vaccine produced by different centres ;
  - (c) distribution of diagnostic sera for use by the public health authorities.

The Committee further recommends that, pending the establishment of such a centre on a permanent basis, one of the existing laboratories, which is suitably equipped, should be entrusted with the tasks suggested.

(iv) *Supply, storage and distribution of vaccine*—The Committee recommends that :—

- (a) States, which do not have facilities for manufacturing vaccine in large quantities, should take immediate steps to increase production ;
- (b) adequate stocks of the vaccine should be maintained at district headquarters and there should be subsidiary depôts at thana headquarters ;

- (c) the Administrative Medical Officer or the Director of Health Services of each State should bear the responsibility of co-ordinating procurement and distribution of vaccine within the State.
- (v) *Cost of vaccine*—The Committee recommends that the State Governments should accept the responsibility of meeting the cost of vaccine for use within the State and that they should ensure that routine administrative and financial procedures do not hamper the effective and timely utilisation of the vaccine.
- (vi) *Dosage of vaccine*—The Committee recommends, as a standard procedure, that one dose of vaccine (1 c.c.) should be given to adults in all mass inoculation programmes. The Committee further recommends that contacts of cholera cases should also be inoculated and children should receive dosage of vaccine according to age.
- (vii) *Inoculation of special groups*—The Committee recommends that a special programme should be instituted for the inoculation of labour employed in the industrial establishments, both in the public and private sectors, as well as of immigrant labour employed in agricultural and other operations. Inoculation of labour should be repeated once every six months.
- (f) *Disinfection procedures*—The Committee recommends that, in the disinfection of water supplies, cholera discharges and fomites, standard procedures, as laid down in the report and in Appendices II and III, should be followed.

#### (5) FORMATION OF ANTI-EPIDEMIC COMMITTEES AT THE DISTRICT LEVEL

The Committee recommends the formation of District anti-epidemic Committees as an essential step in the over-all drive against cholera.

#### (6) HEALTH EDUCATION

The Committee recommends that preparations for health education, as indicated in the report, should be taken in hand as soon as the principle of the eradication programme is accepted and education of the population carried out with increasing tempo so that people are fully ready to receive the programme when it is launched.

#### (7) PILOT PROJECTS

The Committee recommends that, in order to arrive at a fairly comprehensive estimate of the requirements in respect of funds and manpower, each State, in which cholera is at present a major public health problem, should institute a pilot project in a selected area prone to frequent epidemics of cholera.

(8) NEED FOR FURTHER RESEARCH

The Committee recommends the establishment of a permanent unit, with full-time staff, for the purpose of continuing research on the various problems of cholera on the lines indicated in the report.

(9) CENTRAL SMALLPOX AND CHOLERA CONTROL COMMISSION

The Committee recommends that the Government of India should constitute a Central Smallpox and Cholera Control Commission, consisting of members appointed on a full-time basis, on the lines indicated in the report, for the execution of the programme for the control and eradication of smallpox and cholera.





## APPENDIX I

### Incidence of Cholera in India

Statement showing :— (i) Cholera attacks and deaths in States during the period 1948–58, and  
(ii) total number of cholera inoculations performed each year during that period.

#### ANDHRA PRADESH

\*Population : 3,12,60,133 (1951 Census)

Year	Attacks	Deaths	Inoculations
1948	12,593	6,274	N.A.
1949	8,723	4,307	N.A.
1950	15,659	7,934	N.A.
1951	14,286	6,300	N.A.
1952	12,166	5,655	N.A.
1953	30,657	14,802	N.A.
1954	4,563	2,251	N.A.
1955	1,414	684	N.A.
1956	5,761	2,750	N.A.
1957	8,891	3,912	N.A.
1958	10,156	4,805	26,66,060 43,37,584

#### ASSAM

Population : 90,43,707 (1951 Census)

Year	Attacks	Deaths	Inoculations
1948	N.A.	1,320	N.A.
1949	N.A.	1,156	N.A.
1950	N.A.	1,380	N.A.
1951	N.A.	638	N.A.
1952	N.A.	241	N.A.
1953	N.A.	117	N.A.
1954	26	19	N.A.
1955	1,677	916	19,67,921
1956	152	49	7,09,370
1957	236	122	6,66,207

N.A. = Not available.

\*Since the re-organisation of States, population figures would be markedly different in the re-organised States.

**BIHAR**

Population : 4,02,25,947 (1951 Census)

Year	Attacks	Deaths	Inoculations
1949	N.A.	7,856	32,39,032
1950	N.A.	25,483	40,58,676
1951	N.A.	5,924	58,62,269
1952	12,693	5,632	64,94,380
1953	18,361	7,793	99,41,097
1954	4,555	1,425	73,58,800
1955	6,068	2,216	91,59,071
1956	8,071	3,386	1,07,40,042
1957	13,525	5,683	1,12,12,796
1958 (upto 25.10.58)	7,043	2,496	1,37,00,207

**BOMBAY**

Population : 4,82,66,220 (1951 Census)

Year	Attacks	Deaths	Inoculations
1947	12,792	7,980	16,59,250
1948	9,538	5,632	27,59,118
1949	4,652	2,333	17,12,850
1950	8,665	5,116	26,24,634
1951	3,102	1,378	8,86,942
1952	3,069	1,773	17,59,147
1953	37,713	15,302	63,93,070
1954	941	376	7,98,394
1955	647	289	10,70,599
1956	9,900	5,438	42,34,700
1957	17,208	7,086	67,65,338

**KERALA**

Population : 1,35,51,529 (1951 Census)

Year	Attacks	Deaths	Inoculations
1949-50	7	6	N.A.
1950-51	685	353	2,30,000
1951-52	1	1	Nil
1952-53	Nil	Nil	Nil
1953-54	2,228	1,275	15,15,000
1954-55	180	128	68,228
1955-56	Nil	Nil	3,500
1956-57	Nil	Nil	2,809
1957-58	103	40	38,847
1958-59 (till date)	Nil	Nil	N.A.

N.A. = Not available

\* Figures for re-organised Bombay State.

## MADRAS

Population : 5,70,16,002 (1951 Census)

Year	Attacks	Deaths	Inoculations
1948	41,352	33,565	39,95,486
1949	22,469	11,370	27,57,300
1950	67,795	32,593	48,27,722
1951	33,623	17,535	29,78,204
1952	29,793	14,430	41,79,481
1953	44,018	21,489	62,63,555
1954	3,937	2,066	11,99,898
1955	1,080	616	8,63,254
1956	29	13	4,82,429
1957	9,150	4,104	22,86,858
1958	6,408	3,519	24,53,260

## MYSORE

Population : 1,94,01,477 (1951 Census)

Year	Attacks	Deaths	Inoculations
1948	161	844	21,568
1949	2,380	1,337	5,81,231
1950	1,857	956	3,39,424
1951	7,408	2,470	9,00,361
1952	1,803	869	2,80,292
1953	3,236	1,570	9,00,189
1954	3,903	2,073	5,89,097
1955	1,858	965	6,80,193
1956	665	261	3,73,540
1957	4,159	1,675	13,00,181
1958 (From Jan. 1958 to the end of Sept. 1958)	7,329	2,808	14,31,578

N.B. From November 1956 onwards, the figures relate to the New Mysore State.

## ORISSA

Population : 1,46,00,000 (1951 Census)

Year	Attacks	Deaths	Inoculations
1949	5,923	3,288	10,57,023
1950	4,839	2,638	8,14,079
1951	1,078	565	4,93,354
1952	8,102	4,485	8,72,925
1953	3,877	2,145	7,79,255
1954	1,058	523	5,48,538
1955	703	320	7,13,318
1956	9,767	4,246	22,73,959
1957	4,419	2,096	9,42,376
1958 (upto 1.11.58)	8,372	4,517	13,85,248

## PUNJAB

Population : 1,61,34,890 (1951 Census)

Year	Attacks	Deaths	Inoculations
1948	4,723	2,318	7,08,699
1949	459	266	3,40,186
1950	235	122	2,75,105
1951	20	11	1,35,008
1952	180	56	3,07,561
1953	N.A.	N.A.	1,41,803
1954	N.A.	N.A.	2,88,249
1955	N.A.	N.A.	5,25,003
1956	33	10	3,81,681
1957	N.A.	N.A.	2,26,655
1958	27	10	N.A.

## RAJASTHAN

Population : 1,59,70,774 (1951 Census)

Year	Attacks	Deaths	Inoculations
1950	1,142	337	2,14,164
1951	202	43	74,184
1952	873	421	5,09,983
1953	9	6	1,29,526
1954	N.A.	N.A.	76,339
1955	N.A.	N.A.	34,082
1956	N.A.	N.A.	66,404
1957	1	1	68,140
1958 (Upto Oct. 1958).	64	29	21,314

## UTTAR PRADESH

Population : 6,32,00,000 (1951 Census)

Year	Attacks	Deaths	Inoculations
1948	N.A.	52,604	39,40,000
1949	N.A.	25,642	33,10,000
1950	N.A.	6,014	15,60,000
1951	N.A.	5,687	9,80,000
1952	N.A.	10,959	23,00,000
1953	N.A.	11,155	29,80,000
1954	N.A.	2,350	20,10,000
1955	N.A.	1,448	15,20,000
1956	N.A.	3,909	29,80,000
1957	N.A.	16,648	74,80,000

N.A. = Not available.

## WEST BENGAL

Population : 2,84,88,196 (1957)

<i>Year</i>	<i>Attacks</i>	<i>Deaths</i>	<i>Inoculations</i>
1948	25,344	13,789	53,93,076
1949	24,111	13,866	42,80,558
1950	30,880	17,447	52,07,308
1951	13,118	5,676	27,82,596
1952	12,497	6,057	30,57,438
1953	17,291	7,788	42,50,734
1954	4,728	2,011	35,31,237
1955	9,287	3,962	53,18,109
1956	9,040	4,000	66,73,314
1957	8,719	4,075	48,83,265
1958	12,688	5,295	70,35,587



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## APPENDIX II

### Field \*outfit for determination of Chlorine demand and the dose of Bleaching powder for disinfection of water

#### (a) DESCRIPTION OF THE CONTENTS OF THE OUTFIT

Five standard white enamelled tumblers, each capable of holding 500 c.c. of water when filled to the brim.

One metal spoon with holding capacity of 0.7 gm of Bleaching powder, or 1 c.c. of water when filled to the brim.

One glass stirring rod

One 6 inches rule

One orthotoluidine outfit, including a Chlorine comparator.

#### (b) INSTRUCTIONS FOR DETERMINING THE DOSAGE OF BLEACHING POWDER

- (1) Place in one of the tumblers one level spoonful of Bleaching powder, using the metal spoon of the outfit, and make it into a paste with a little water, stirring with the glass rod and carefully breaking up lumps. Then add more water to *fill the tumbler* and stir vigorously with the glass rod.
- (2) Arrange the other 4 tumblers in a row. Add one, two, three and four spoonfuls of the solution of Bleaching powder made in the first tumbler to these four tumblers, one spoonful in the first, two spoonfuls in the second, three spoonfuls in the third and four spoonfuls in the fourth, beginning with the tumbler on the left, and fill them with the water to be disinfected. Stir the contents of the tumblers thoroughly with a clean glass rod and allow the tumblers to stand undisturbed for half an hour.
- (3) After this contact period of half an hour, determine by the orthotoluidine test described later the residual chlorine in the contents of each of the four tumblers in which different dilutions of the solution from the first cup were made.

The first of these four tumblers, which shows a light yellow colour with the orthotoluidine test, signifies satisfactory residual chlorine and indicates the dosage of Bleaching powder for adequate disinfection.

To be accurate, however, the sample should show the presence of 0.2 p.p.m. residual chlorine. The quantitative determination of residual

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\* Recommended by the All-India Institute of Hygiene and Public Health, Calcutta. See also reference "Errors in the use of field testing outfits in the disinfection of water". T.R. Bhaskaran *et al.* Water and Water Engineering, 1944, vol. 47, pp. 499-505.

chlorine requires the use of a Chlorine Comparator which is described later and forms part of the outfit.

- (4) If satisfactory residual chlorine is not found in any of the 4 tumblers, throw away their contents and repeat the procedure as in (2), using higher dilutions of the Bleaching powder solution. Five spoonfuls of the solution may be added to the first tumbler, six to the second, seven to the third and eight to the fourth.
- (5) Note the number of spoonfuls of Bleaching powder solution added to the tumbler showing satisfactory residual chlorine. *Each spoonful of the solution corresponds to 3.6 p.p.m. of chlorine or 1 spoonful of Bleaching powder for every 44 gallons of the water in question.*
- (6) The actual quantity of Bleaching powder required for disinfecting a given quantity of water may be computed as follows :—

If 'n' spoonfuls of the solution have been added to the cup giving satisfactory residual chlorine, and 'G' gallons of water are to be disinfected, then add to that quantity of water,  $\frac{nG}{44}$  spoonfuls of Bleaching powder or  $\frac{3.6 nG}{100,000}$  lbs. of Bleaching powder, taking care to use Bleaching powder from the source from which it was taken to make a solution for the orthotoluidine test.

(c) THE ORTHOTOLUIDINE TEST AND THE DETERMINATION OF RESIDUAL CHLORINE

Take the test tube with 10 c.c. mark provided in the outfit and fill it up to the 10 c.c. mark with the sample of chlorinated water to be tested. Add ten drops of orthotoluidine solution. Shake and mix well. Wait for 2-3 minutes. If sufficient residual chlorine is present, a colour varying from light yellow to deep orange will develop, depending on the quantity of residual chlorine present in the sample. A light yellow colour indicates satisfactory residual chlorine content. A deep orange colour indicates that the residual chlorine is too high.

The residual chlorine content of the samples can, however, be determined quantitatively with greater accuracy by matching the colour developed in the sample of water tested with the orthotoluidine test with one of the colours in the sealed tubes provided with the Chlorine Comparator of the outfit. These standard colours represent 0.1, 0.2, 0.3, 0.4, in that increasing order, of p.p.m. of chlorine. In the absence of such an outfit we may consider the development of a light yellow colour, under the conditions described above, a rough index of adequate residual chlorine and an indicator of the quantity of Bleaching powder required for disinfection.

- (d) The required quantity of Bleaching powder can be measured out readily in one of the tumblers, using the 6 inches foot rule and glass rod for the purpose.

The powder should *not* be pressed. When the tumbler is filled to a height of 1.5 inches it would hold  $\frac{1}{3}$  lb. of Bleaching powder, when filled to a height of 2.4 inches it would hold  $\frac{1}{2}$  lb of Bleaching powder and when filled to a height of 4.2 inches it would hold  $\frac{1}{3}$  lb. of Bleaching powder.

(e) When disinfecting water, Bleaching powder should be added only in the form of a solution. The measured quantity of the powder is first dissolved in a small quantity of water to form a paste and then diluted suitably. This solution should be allowed to stand for five minutes and then dispersed evenly in the well or tank, care being taken to avoid concentration in any one place. While mixing, the bottom of the tank or well must not be disturbed.

(f) The residual chlorine of the water should be tested by the orthotoluidine test described at (c) earlier half an hour after adding Bleaching powder. The residual chlorine should be at least 0.2 p.p.m. for successful disinfection.





## APPENDIX III

### Disinfection of Tube-wells

#### *Instructions*

#### THE PRINCIPLE

The idea of disinfection of tube-wells is not to disinfect the underground water sources from which water is drawn, but to disinfect the component parts of the tube-well, e.g., the pump, the inside of the pipes, the leather buckets, the filter, etc., which are usually the seats of pollution. The disinfection of a tube-well is undertaken when it is newly sunk or resunk, or when there is evidence of pollution in spite of discarding large quantities of water by hard pumping.

#### THE PROCEDURE

1. Dismantle the pump.
2. Calculate the volume of the tube in terms of gallons, using the formula  $5 D^2 H$ , D being the diameter and H the depth in ft. of the tube.

The depth can be measured by lowering a weighted tape down the tube-well pipe.

3. As disinfection has to be done with a solution having 50 p.p.m. of chlorine, prepare a solution of that strength by adding about 1 gm or 15 grains of Bleaching powder of 25 per cent available chlorine strength for every gallon of water.
4. Pour the solution, prepared as at 3 above, into the tube.
5. Prepare a similar solution and immerse the dismantled parts of the pump in it separately.
6. Observe a contact period of at least 2 hours in both the cases; 6 hours contact period is desirable.
7. At the end of this period, pump out water from the tube-well until excess chlorine disappears and then allow the people to use the tube-well.
8. Residual chlorine has no significance in tube-well disinfection.

N.B. If, however, it is not possible to dismantle the tube-well and disinfect it in the manner described above, then fill up a reservoir with water from the tube-well and chlorinate it in the usual way as described in the note. The procedure of chlorinating a tube-well may be continued till it is satisfactorily disinfected and the water is found bacteriologically safe.

## APPENDIX IV

### Storage and distribution of Bleaching Powder

1. *Availability*—Bleaching powder is available in two varieties, stabilised and unstabilised. The former is manufactured by Mettur Chemicals in South India and the latter by Rohtas Industries in Bihar.

The chlorine content of both the varieties is 30 per cent w/w. The life of stabilised Bleaching powder is normally taken as one year, for which period it retains its chlorine content intact. The potency of unstabilised Bleaching powder lasts for about 3 months from the date of manufacture and its chlorine content falls rapidly thereafter.

2. *Containers*—Bleaching powder should be stored in containers with properly fitting lids so as to prevent entry of excess of moisture. Army Authorities have detailed specifications for Bleaching powder and its containers. Messrs. Mettur Chemicals supply Bleaching powder in 56 lbs. drums, 28 lbs. drums or 7 lbs. tins. A good container is that which is airtight, has no loose joints and is not corroded by Bleaching powder. Containers should also be strong enough to withstand rough handling while in transit, otherwise an accidental knock may crack it open and expose the contents to moisture, with resulting deterioration in quality.

3. *Storage*—The containers should be stored in cool, dry and dark places to minimise deterioration of their contents.

4. *Use*—The contents of a container once opened should be used up the same day. Bleaching powder left in an open container soon deteriorates.

#### 5. *Reserve stocks*

(a) *In a State*—Reserve stocks of Bleaching powder maintained by a State will evidently depend upon its population, area, and the frequency of occurrence of cholera epidemics. From experience gained in dealing with emergencies in the States of Madras, Andhra, Bihar, Assam and Orissa, it is felt that a State reserve of 50 tons would be adequate. In case of further need, reserves of one State can be borrowed by another.

(b) *In a District*—100 drums of 56 lbs. each of Bleaching powder as reserve stock for each district are considered to be a fair estimate. In case of further need, the needy district can borrow from the reserves of other districts.

(c) *In a Village*—A reserve stock of one hundredweight or two drums of 56 lbs. or 16 tins of 7 lbs. each of Bleaching powder is considered adequate for a village.

N.B. (i) Proper turnover of all reserve stocks must be arranged.

(ii) Reserve stocks should be held by those districts which are known to be endemic foci of cholera or which get epidemic visitations of cholera.

(iii) Only key villages in endemic areas or in areas known to get epidemics of cholera should hold reserve stocks.

6. *Monetary value of reserve stocks*—Bleaching powder will normally be available at half a rupee per lb. Based on this rate, the monetary values of the reserve stocks would be as follows :—

State	...	...	...	Rs.	56,000
District	...	...	...	Rs.	5,600
Village	...	...	...	Rs.	56



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## APPENDIX V

### List of articles required for one 50-Bedded Mobile Hospital Unit

Sl. No.	Name of article	Quantity required
1	2	3
<b>VEHICLES</b>		
1.	Motor Chassis 153 Wheel Base	2
<b>FURNITURE</b>		
2.	Cots	50
3.	Bed side tables	50
4.	Cupboards large for medicines and instruments	10
5.	Poisons cupboard	1
6.	Frames for diets and case sheets	50
7.	Tables large for ward medicines	10
8.	Small tables or teapoys for dressings and injections	5
9.	Kitchen Table	1
10.	Benches for convalescent patients	5
11.	Wooden screens (Frames)	5
12.	Chairs	10
13.	Meat Safes (medium size)	2
14.	Ice Box	1
15.	Soiled Linen Boxes (large)	2
16.	Stools	5
17.	Back rests	5
18.	Stretchers (folding)	2
19.	Wash basin stands	3
<b>LAMPS</b>		
20.	Petromax	2
21.	Hurricane Lanterns	10
22.	Torches	3

1	2	3
<b>APPLIANCES</b>		
23.	Kettle	1
24.	Spittoons	50
25.	Buckets G. I.	4
26.	Stoves Primus	5
27.	Jugs Enamel	3
28.	Wash basins	3
29.	Mugs enamel	4
30.	Persian Heater for hot water	1
31.	Mattresses (coir)	50
32.	Draw Sheets	100
33.	Bed Sheets	100
34.	Pillows (coir)	50
35.	Pillow Cases	100
36.	Durries	2
37.	Blankets	50
38.	Mosquito nets	50
39.	Towels for patients and staff	150
40.	Pyjama suits	75
41.	Night suits for females	50
<b>KITCHEN UTENSILS</b>		
42.	Big Degchies with covers	6
43.	Medium Aluminium Degchies with covers	6
44.	Big Thalís for mixing flour	2
45.	Tavas plain	2
46.	Tavas curved	2
47.	Ladles large	4
48.	Buckets medium	4
49.	Spoons brass large	4
50.	Mortar and pestle iron	1
51.	Curry stone and roller	1
52.	Zara iron medium	2
53.	Vili for cutting vegetables	1



1	2	3
54.	Scales with weights	1
55.	Knives table	2
56.	Mutton chopper	1
57.	Kalthas iron	2
58.	Tongs iron	1
59.	Rolling Boards and Pins	2
60.	Churner	1
61.	Sigrees	5
62.	Kettle large	1
63.	Bread Knife	1
FEEDING UTENSILS		
64.	Thalis	50
65.	Matis or Katoras	50
66.	Brass tumblers	50
67.	Sauce pans	3
68.	Table knives	3
69.	Table spoons	6
70.	Feeding cups	6
71.	Tea spoons	6
72.	Tea strainers	2
73.	Lemon squeezers	2
74.	Cups and saucers	3



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**List of instruments and drugs required for one 50-Bedded Mobile  
Hospital Unit**

Sl. No.	Name of article	Quantity required
1	2	3
1.	Catheters (Metal) Male	2
2.	Catheters (Metal) Female	2
3.	Catheters Rubber	6
4.	Flatus Tubes	2
5.	Ryles Tubes	2
6.	Syringes 2 cc.	3
7.	Syringes 5 cc.	2
8.	Syringes 10 cc.	2
9.	Scissors surgical	4
10.	Forceps Dressing	4
11.	Probes	2
12.	Scalpels	4
13.	Tongue Depressors	2
14.	Forceps artery	2
15.	Tourniquet	1
16.	Intravenous Saline apparatus	1
17.	Splints assorted	1 set
18.	Urinals	10
19.	Bed Pans	10
20.	Enema cans	2
21.	Mackintosh, 2 yard pieces	10
22.	Bowls for dressing	5
23.	Trays for instruments	5
24.	Kidney Trays	5
25.	Drums (for dressings)	3
26.	Sauce pans for sterilizing	2
27.	Kettle	1
28.	Clinical Thermometers	5



1	2	3
29.	Medicine glasses (1 oz.)	4
30.	Measure glasses	4
31.	Hot water bottles	5
32.	Air cushions	2
33.	Balance with weights	1
34.	Mortar and pestle	1
35.	Ointment slab and knife	1
36.	Bottles for stock mixtures	10
37.	Drop bottles	4
38.	Acid Boricum	5 lbs.
39.	Aqua distilata	4 lbs.
40.	Argenti Nitras Induratus	3 oz.
41.	Cupri Sulphas	3 oz.
42.	Hydrargyrum-cum-crete sacharata	1/2 lb.
43.	Lin Camphor Ammoniatum	5 lbs.
44.	Liquor Ammon. Acetat. Fortis	5 lbs.
45.	Mag. Carbonas Levis	1 lb.
46.	Mag. Sulphas	20 lbs.
47.	Oleum Menthae Pip	2 oz.
48.	Oleum Ricini	5 lbs.
49.	Opii (1 gr.) pills	25
50.	Pill scillae Co. 4 grs.	500
51.	Potassium Permanganate	1 lb.
52.	Spiritus Aetheris Nitrosi	2½ lbs.
53.	Spiritus Rectificatum (90% alcohol)	2 lbs.
54.	Tab. Hydrargyri perchloride. 8-3/4 gr.	100
55.	Tab. Emetine Hydrochlor (½ gr.) tubes	10
56.	Tab. Morphine Tartaras. (¼ gr.) tubes	5
57.	Tab. Strych. Hydrochlor (1/60 gr.) tubes	5
58.	Tab. Ammonia Carbonas (5 grs.)	1000
59.	Tab. Hydrargyri Subchloride, 2 gr.	100
60.	Tab. Iron Quinina Arsenic C D. 3½ grs.	1000
61.	Phenacetin (5 gr.) tablets	500
62.	Tab. Potassii Bromidum (10 grs.)	500



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2	3
63. Potassium Permanganate tabs. (salol coated, 2 grs.)	750
64. Tab. Potassii Iodidum (5 grs.)	500
65. Tab. Santonine (1 gr.)	250
66. Tab. Pulvis Ipecac. et Opii (5 grs.)	1000
67. Tab. Sodii Bicarbonas (5 grs.)	1000
68. Tab. Sodii Salicylate (5 grs.)	1000
69. Tab. Quinine Sulphas. (5 grs.)	3000
70. Liquor Iodi Mitis	4 lbs.
71. Unguentum Acid Boric	4 lbs.
72. Unguentum Sulphuris	8 lbs.
73. Bandages loose wove	400
74. Gauze Surgical	100 yds.
75. Lint 1/2 lb. packets	5 lbs.
76. Tow Carbolized (2 oz.) packets	5 lbs.
77. Wool Cotton absorbent	10 lbs.
78. Plaster Adhesive, Zinc Oxide	2 spools
79. Tablets Digitalin (1/100 grs.)	5 tubes
80. Sulphadiazine tabs.	5000
81. Sulphaguanidine tabs.	5000
82. M. & B. 693 tabs.	5000
83. Calcium Lactate powder	1 lb.
84. Cresol or Lysol white	6 gallons
85. Multivitamin tablets	5000
TENTS	
86. Tents I.P. private M.K. II, complete	25
87. Tents I.P. 180 lbs.	40

## APPENDIX VI

### **A short note on tube-well studies carried out by the Indian Council of Medical Research in Bihar State (1956-59)**

One of the satisfactory methods of providing safe water in rural areas is through tube-wells. Many tube-wells, fitted with hand pumps, have been installed in different parts of the country in implementation of the water supply programme for rural areas. Earlier work carried out in connection with tube-wells at the All-India Institute of Hygiene and Public Health, Calcutta and the experience gained with such wells in the States of West Bengal and Bihar during the pre-plan period showed that a number of problems require to be studied if the tube-well is to serve as a cheap and efficient method of supplying safe water in rural areas. Studies carried out in Singur (West Bengal) showed that the cost of maintenance of tube-wells in this region was about Rs. 10 per well per annum. The experience in Bihar State on the other hand indicated that maintenance cost in other areas would be higher. Collection of data pertaining to the problems of maintenance of tube-wells, such as the nature of repairs they need, the frequency with which repairs become necessary, their cost, etc., is required before a satisfactory maintenance service is evolved. It has been observed that the life of tube-well strainers, which ultimately determines the cost of provision of safe water, is very limited.

In view of the foregoing considerations, the Indian Council of Medical Research initiated studies on tube-wells in Bihar State in 1956 with a view to collecting precise data on the cost of repairs, their nature, the frequency with which repairs became necessary, types of service required and related problems.

The study was confined to villages in north Bhagalpur District. A field unit, with a small laboratory for chemical examination of water samples and a store, was established in the village of Naugachia served by the Sonepur-Katihar section of the N.E. Railway. The Mechanician, who was in charge of the field observations, was stationed at Naugachia. The other field staff stayed in the villages, carried out regular inspection of tube-wells and collected the required data from time to time. Water samples from the wells were sent to Naugachia Laboratory for analysis. 290 tube-wells (1½" diameter size) were kept under observation for a period of 2 years.

The results of the studies carried out in Bihar have shown :

(i) That the cost of maintenance of tube-wells in Bihar villages is Rs. 8.21 for materials and Rs. 12.87 for personnel, thus bringing the total to Rs. 21.08 per well per annum.

If one tube-well serves a population of 150, the per capita cost of its maintenance would be 14 nP per annum.

- (ii) That with the present method of sinking tube-wells, the common types of strainers have a limited life.

It was observed that all the mesh-type strainers and over 30 per cent of the Jacket-type strainers, with slots, had a life of less than 5 years. The all-brass strainers had a life of only 2 years. These observations indicate that, in addition to the maintenance cost of 14 nP per capita per annum, funds for additional recurring expenditure will also be required for replacement and repair of strainers and resinking of tube-wells.

- (iii) That the type of strainer used under different soil conditions and different kinds of underground water is an important factor in determining the longevity of the life of the wells and the economics of their maintenance.

The Bihar studies also emphasised the need for carrying out further systematic investigations with different types of strainers under different soil and water conditions to evolve strainers which would suit different regions in the country.

The Indian Council of Medical Research proposes to investigate this aspect of the problem in the States of Bihar and West Bengal during 1959-60, using strainers which will be fabricated within the country. As a result of these investigations, it may be possible to work out suitable procedures by which water supplies in rural areas through tube-wells would be available at cheap cost and without frequent breakdowns.



## Statement showing the centres manufacturing cholera vaccine in India

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State and name of the Institute, with complete address. 1	Present production capacity. 2	Maximum production capacity. 3	What facilities would be required to step up production. 4
<b>1. Andhra Pradesh</b> Institute of Preventive Medicine & Central Laboratory, Narayanguda, Hyderabad A.P.	2,500,000 ccs. per annum. 2 to 2½ lakh ccs. of vaccine can be prepared each month.	3,500,000 ccs. per annum. With the present staff and equipment, an extra quantity of about 10 to 12 lakh ccs. can be manufactured in the whole year, at the rate of 100,000 extra ccs. per month.	Extra staff as per details as under :— 1. Lab. Technician ... 1 (Rs. 50-100) 2. Lab. Attendants ... 2 (Rs. 45-50) 3. Kamaties ... 4 (Rs. 18-21)
<b>2. Assam</b> Pasteur Institute & Medical Research Institute, Shillong.	Between 200,000 and 240,000 ccs. per month.	About 400,000 ccs. per month.	Extra staff and materials.
<b>3. Bihar</b> State Cholera Vaccine Laboratory, Patna.	11,000,000 ccs. per year.	...	Production will have to be increased to meet the entire requirements of the State.
<b>4. Bombay</b> (a) Haffkine Institute, King Edward Road, Parel, Bombay-12. (b) Public Health Laboratory, Nagpur.	3,500,000 ccs. per month. 160,000 ccs. per month.	5,000,000 ccs. per month. 200,000 ccs. per month.	To employ a number of temporary personnel for this extra amount Rs. 5,000 per month may be placed at the disposal of the Director for use at his discretion.
<b>5. Kerala</b> Public Health Laboratory, Trivandrum.	60,000 ccs. per month.	240,000 ccs. per month.	To ensure maximum production, as noted in Col. 3, annual extra provision of Rs. 18,500 is needed.

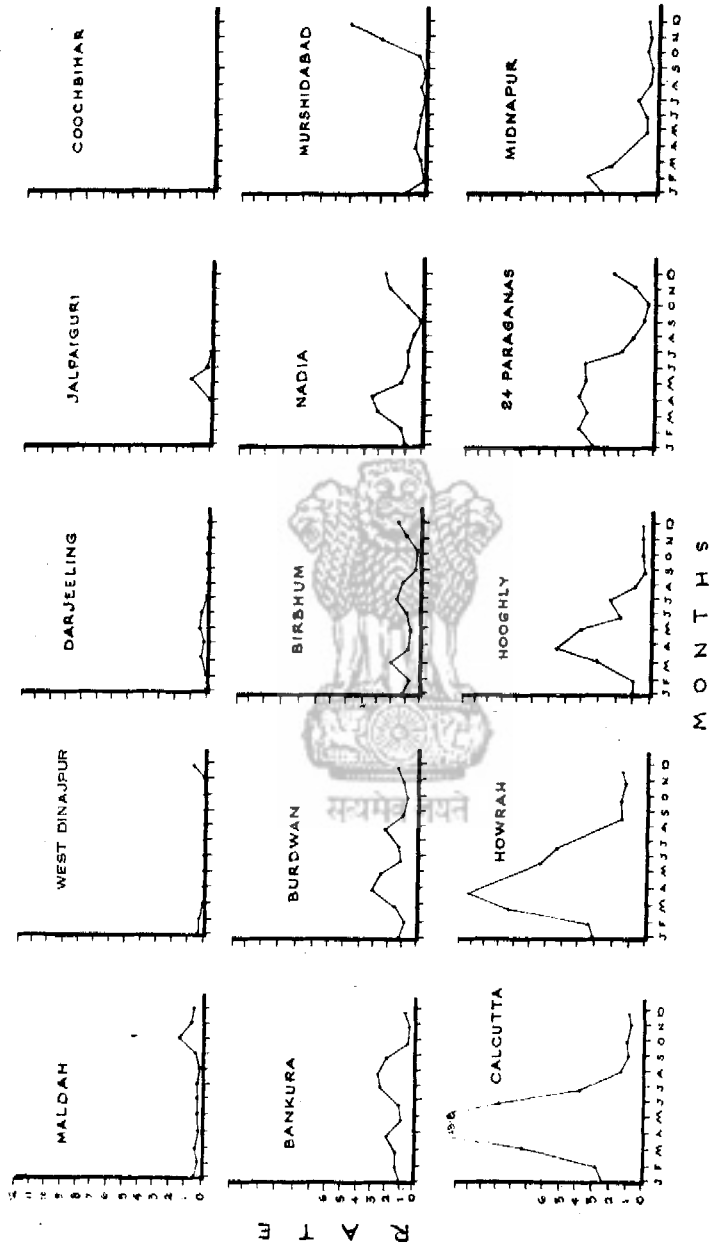
<b>6. Madras</b>	10,000,000 ccs. per year.	15,000,000 ccs. per year.	Additional working space, duplicate equipment and extra staff are required for stepping up production.
<b>7. Mysore</b>	1,500,000 ccs. per year.	...	The production will have to be doubled to meet the requirement of the State.
<b>8. Punjab</b>	240,000 ccs. per month.	400,000 to 800,000 ccs. per month.	10 daily labourers (for this extra sanction will be necessary.)
<b>9. Uttar Pradesh</b>	3,000,000 ccs. per year.	4,800,000 ccs. per year by working beyond normal duty hours.	A sum of Rs. 40,000 would be required to meet expenses in connection with purchase of chemicals and equipment and grant of special pay to staff for working beyond normal duty hours for producing extra vaccine at this Institute.
<b>10. West Bengal</b>	320,000 ccs. per month.	400,000 ccs. per month.	<p>Equipment :</p> <ol style="list-style-type: none"> <li>1. Electric Incubators (5" x 8") ... Two</li> <li>2. Electric Autoclaves (18" x 36") ... Four</li> <li>3. Automatic filling &amp; Sealing Machines... Two</li> <li>4. Filling Boxes ... Two doz.</li> <li>5. Hot Air Ovens ... Two.</li> </ol>

N.B.—Cholera vaccine is also manufactured by some pharmaceutical concerns in West Bengal.



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CHART I



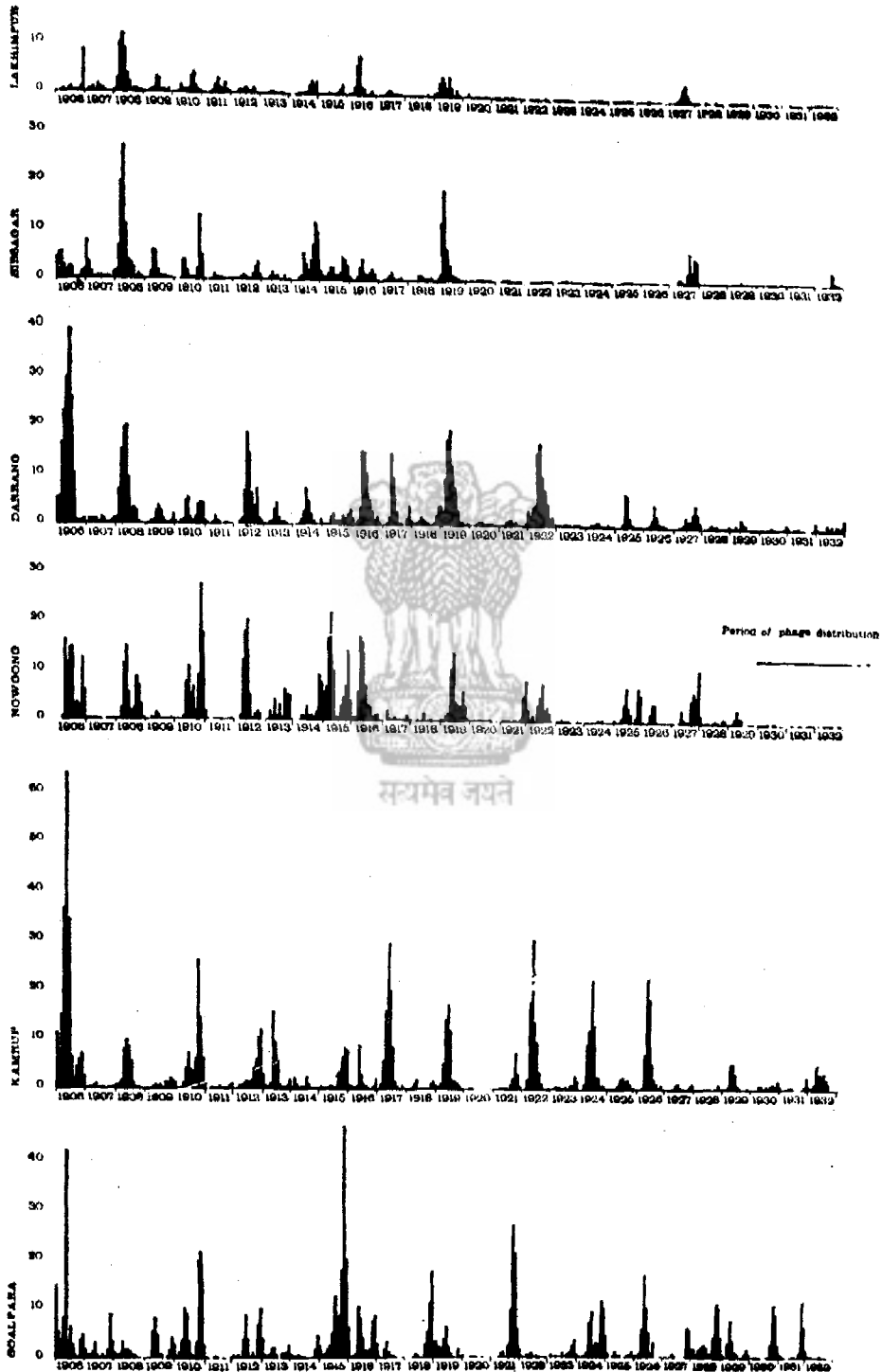
SEASONAL INCIDENCE OF CHOLERA IN WEST BENGAL 1947-57 (DISTRICT-WISE)  
 ENDEMICITY - RATE PER 100,000.



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Incidence of cholera in six Districts of Assam  
1906-1932





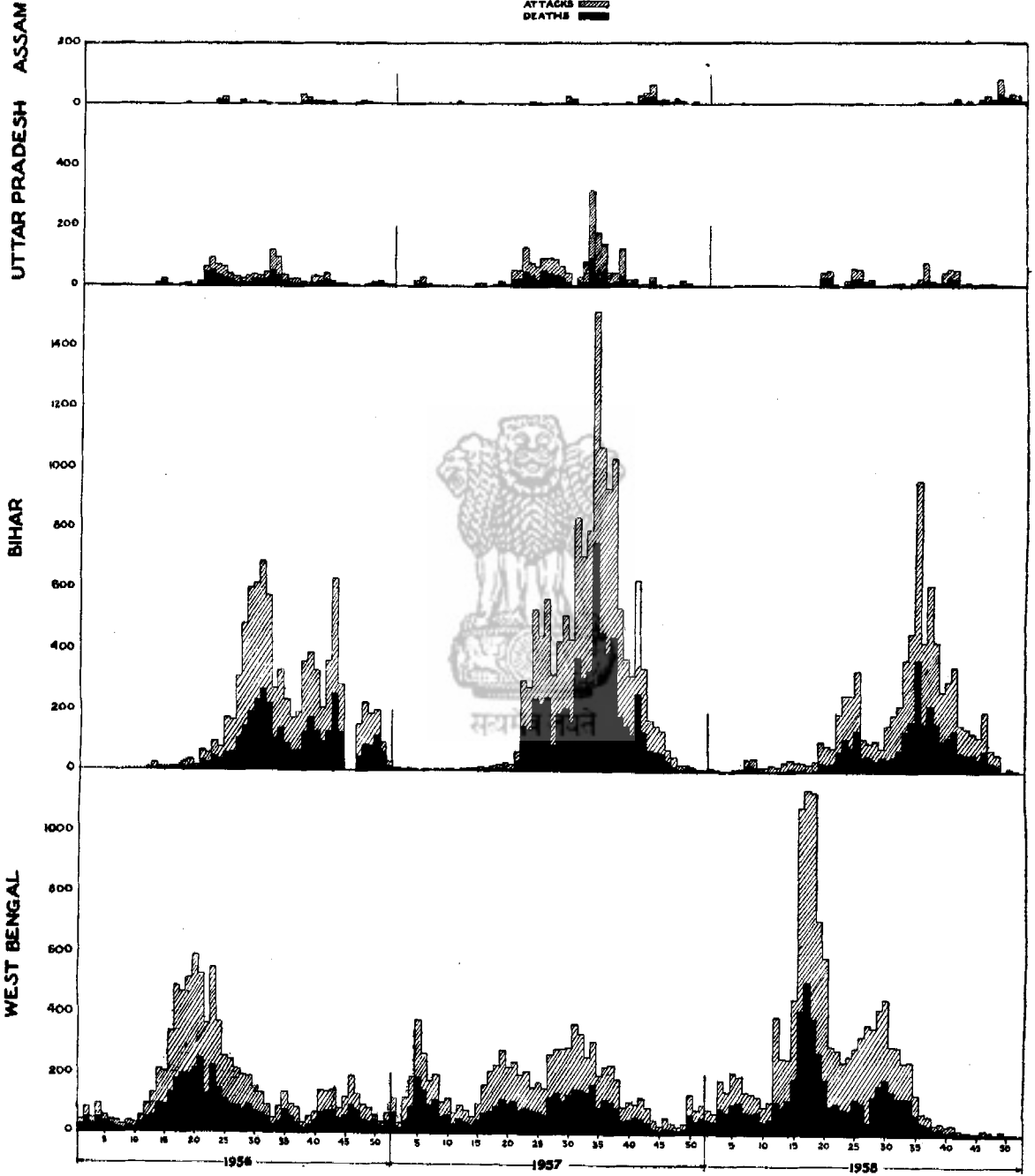
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# CHOLERA

## WEEKLY ATTACKS AND DEATHS

1956-1958

INDEX

ATTACKS  DEATHS 





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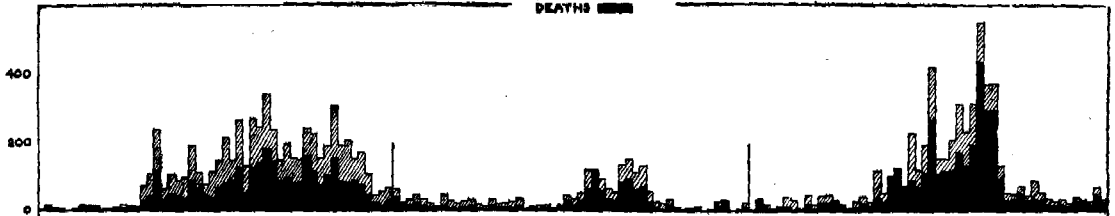
# CHOLERA

## WEEKLY ATTACKS AND DEATHS

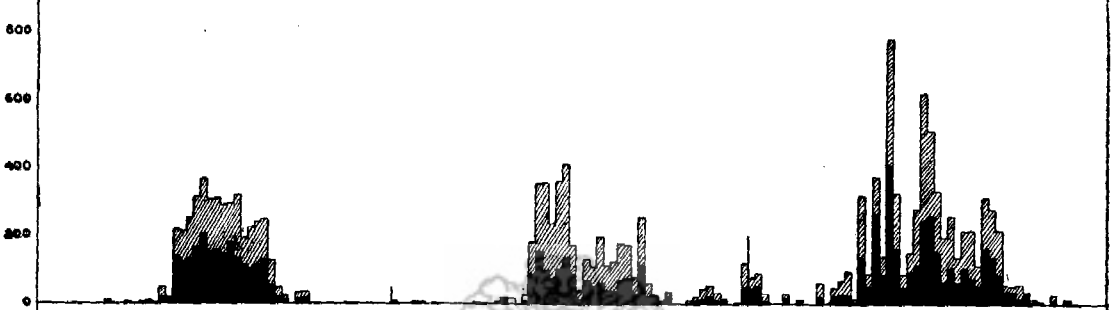
1956-1958

 INDEX  
 ATTACKS   
 DEATHS 

ORISSA



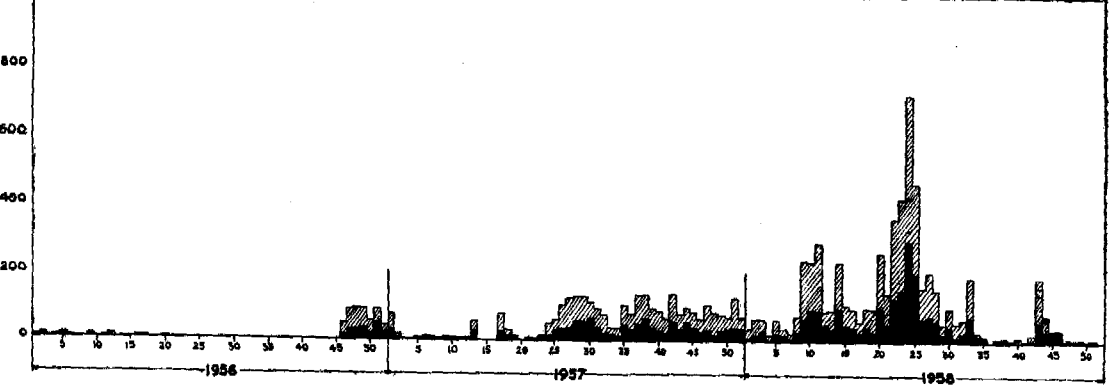
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BOMBAY



MYSORE







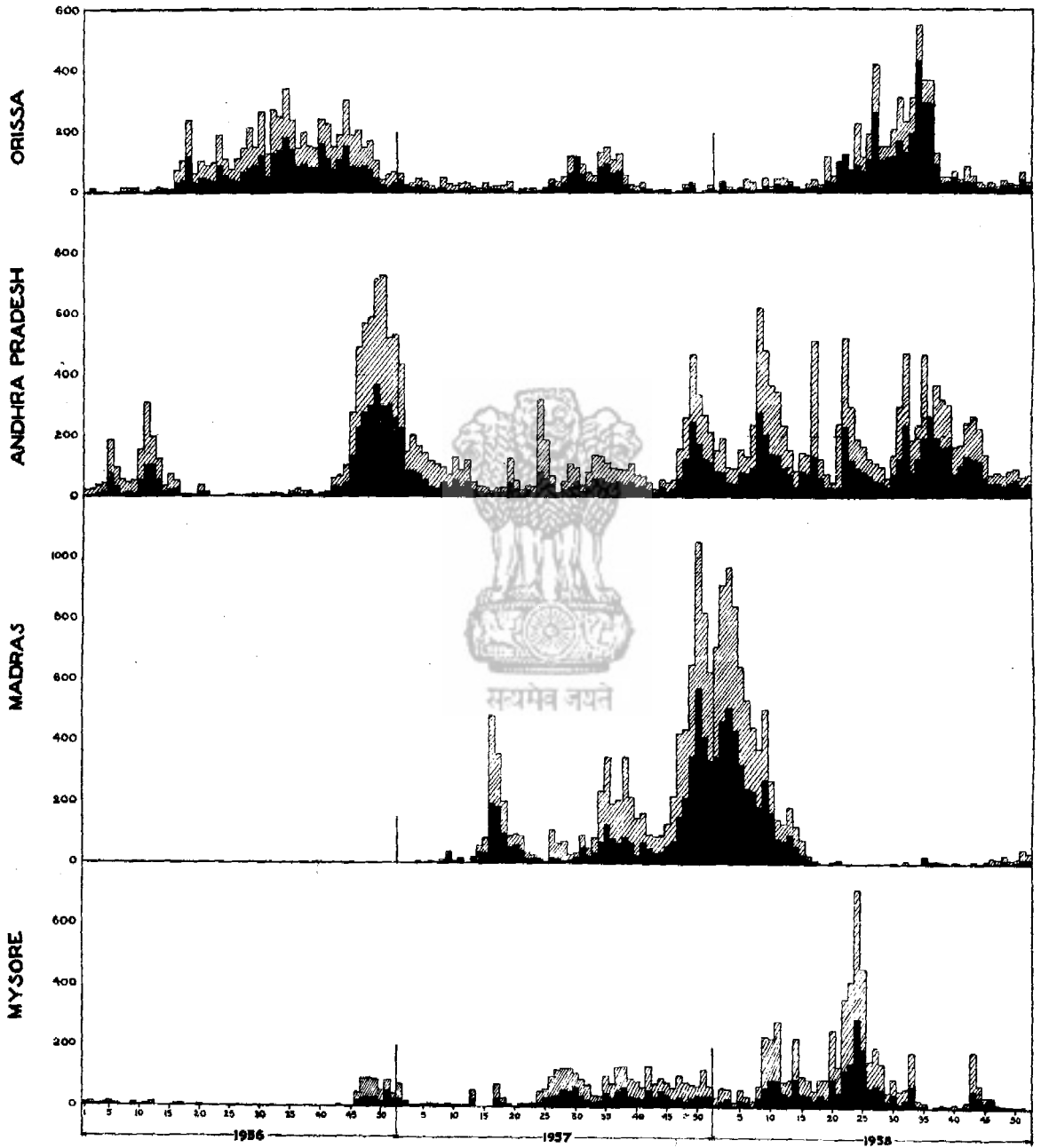
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# CHOLERA

## WEEKLY ATTACKS AND DEATHS

1936-1938

INDEX  
 ATTACKS   
 DEATHS 

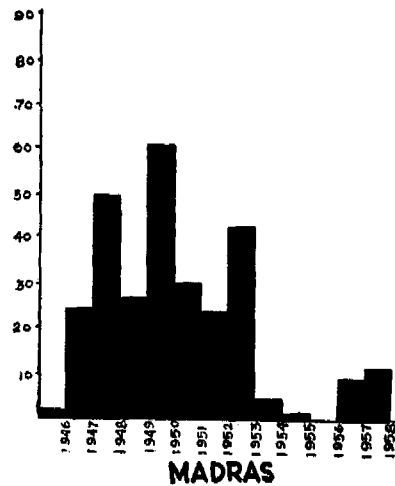
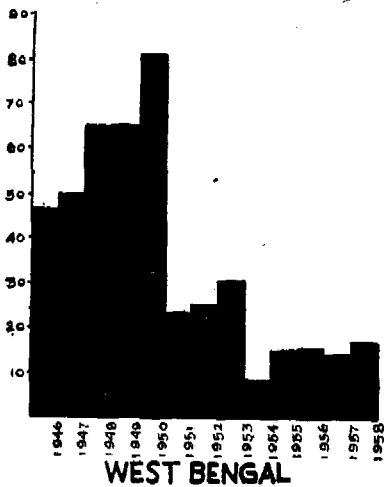
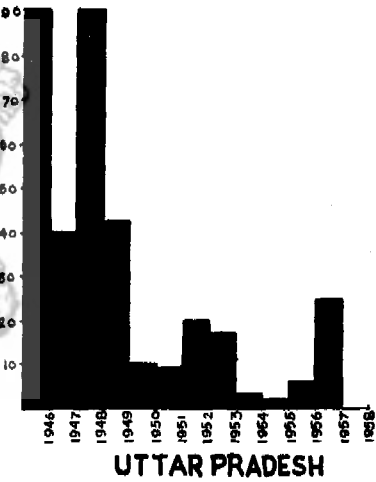
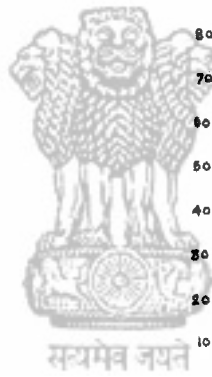
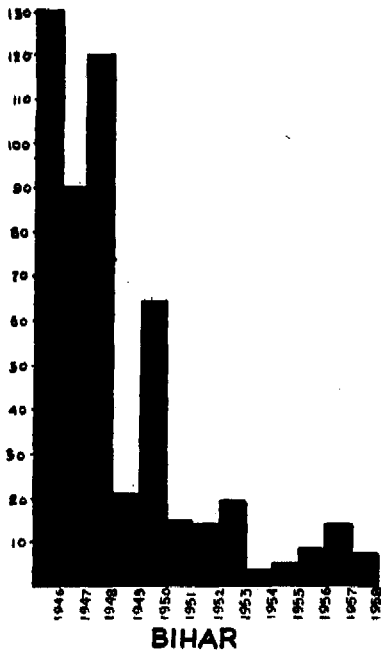
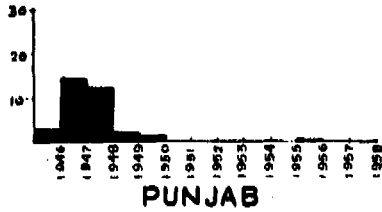




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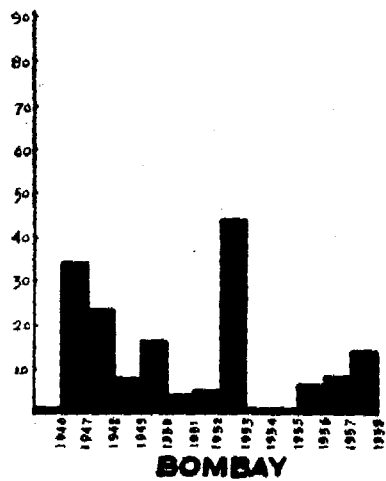
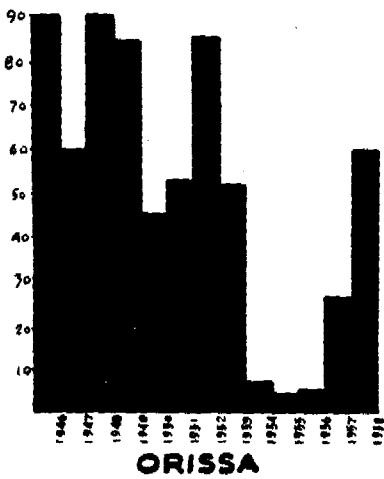
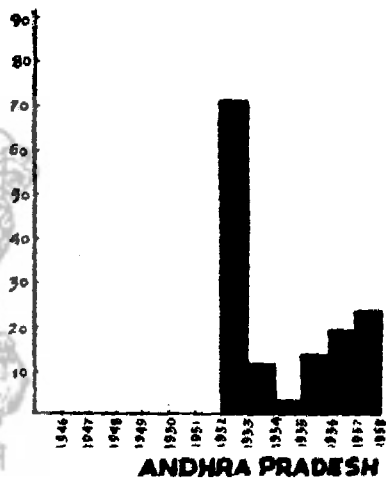
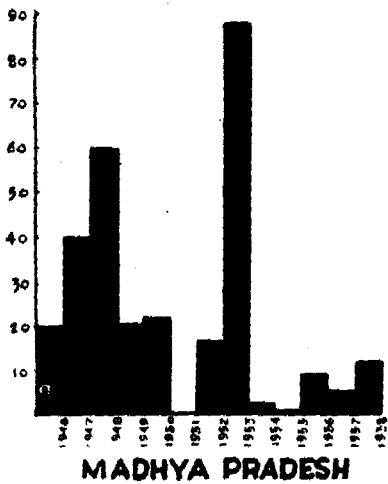
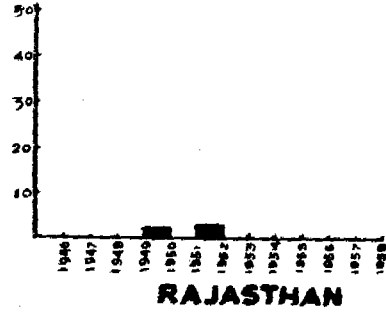
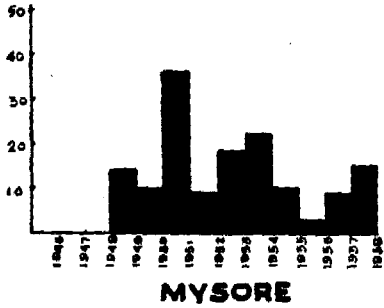
**CHOLERA IN INDIA**  
ANNUAL SPECIFIC DEATH RATES PER 100,000 POPULATION  
IN DIFFERENT STATES  
1946-58





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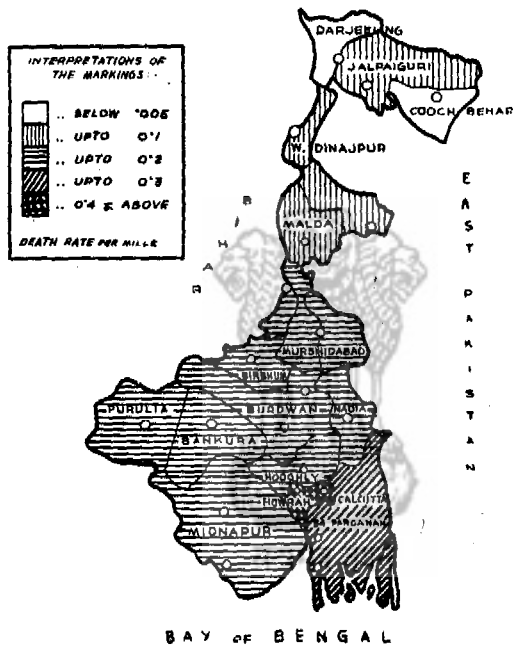
**CHOLERA IN INDIA**  
ANNUAL SPECIFIC DEATH RATES PER 100,000 POPULATION  
IN DIFFERENT STATES  
1946-58





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**MAP OF WEST BENGAL SHOWING THE  
DISTRICTWISE AVERAGE MORTALITY  
DISTRIBUTION OF CHOLERA DURING  
THE YEARS 1952 - 1956**





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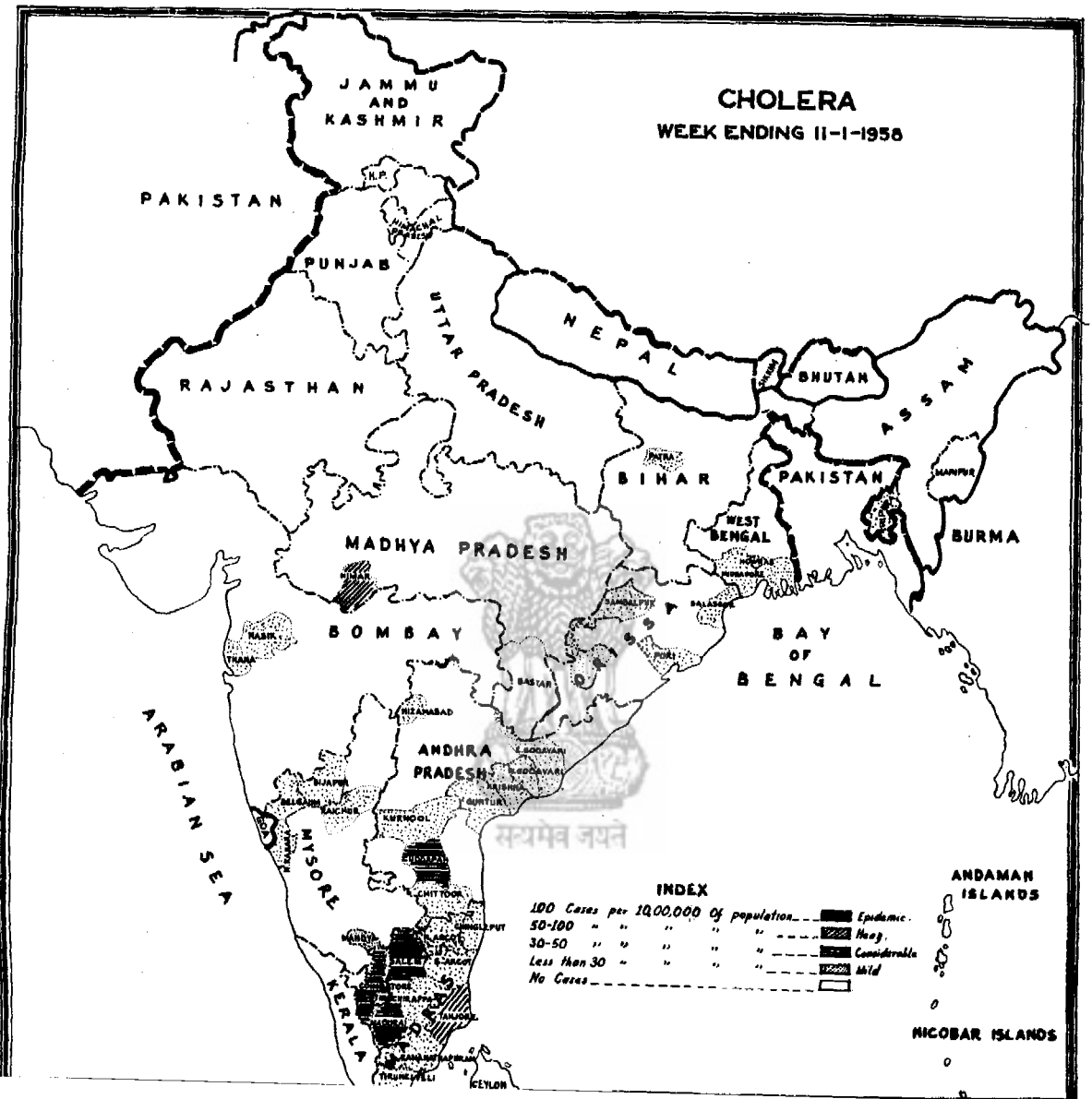
# CHOLERA IN MADRAS STATE

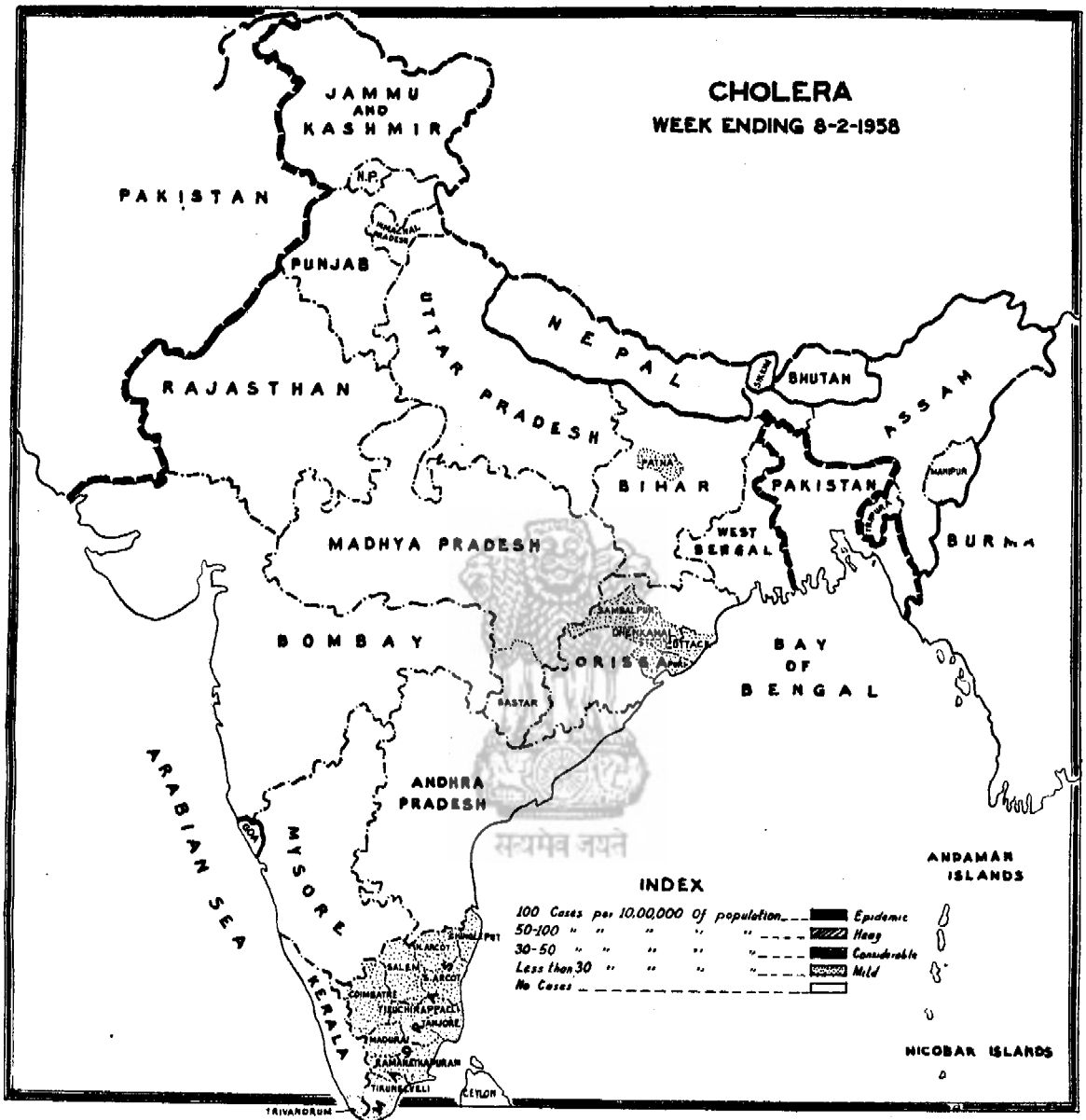
1957—58

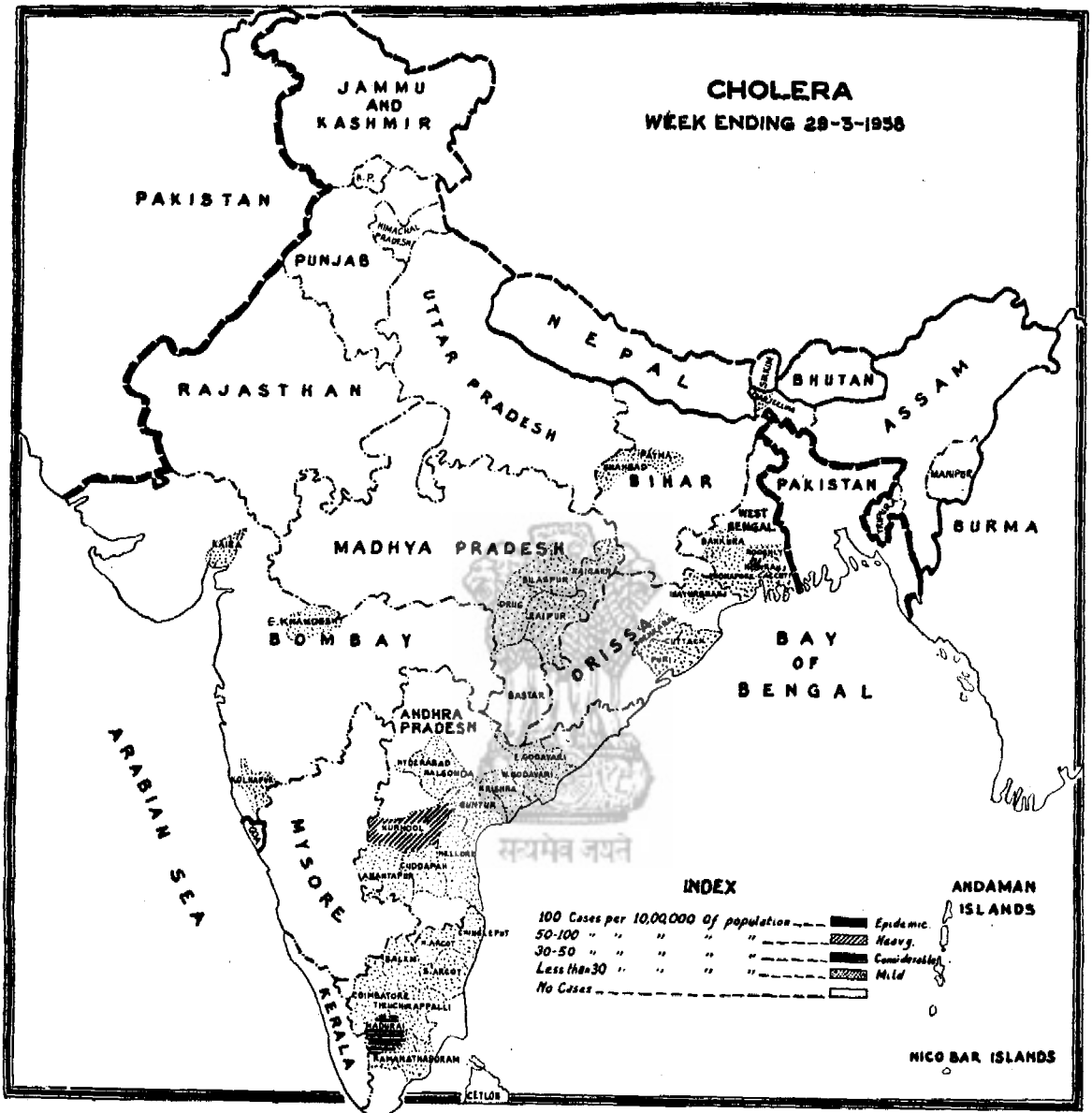




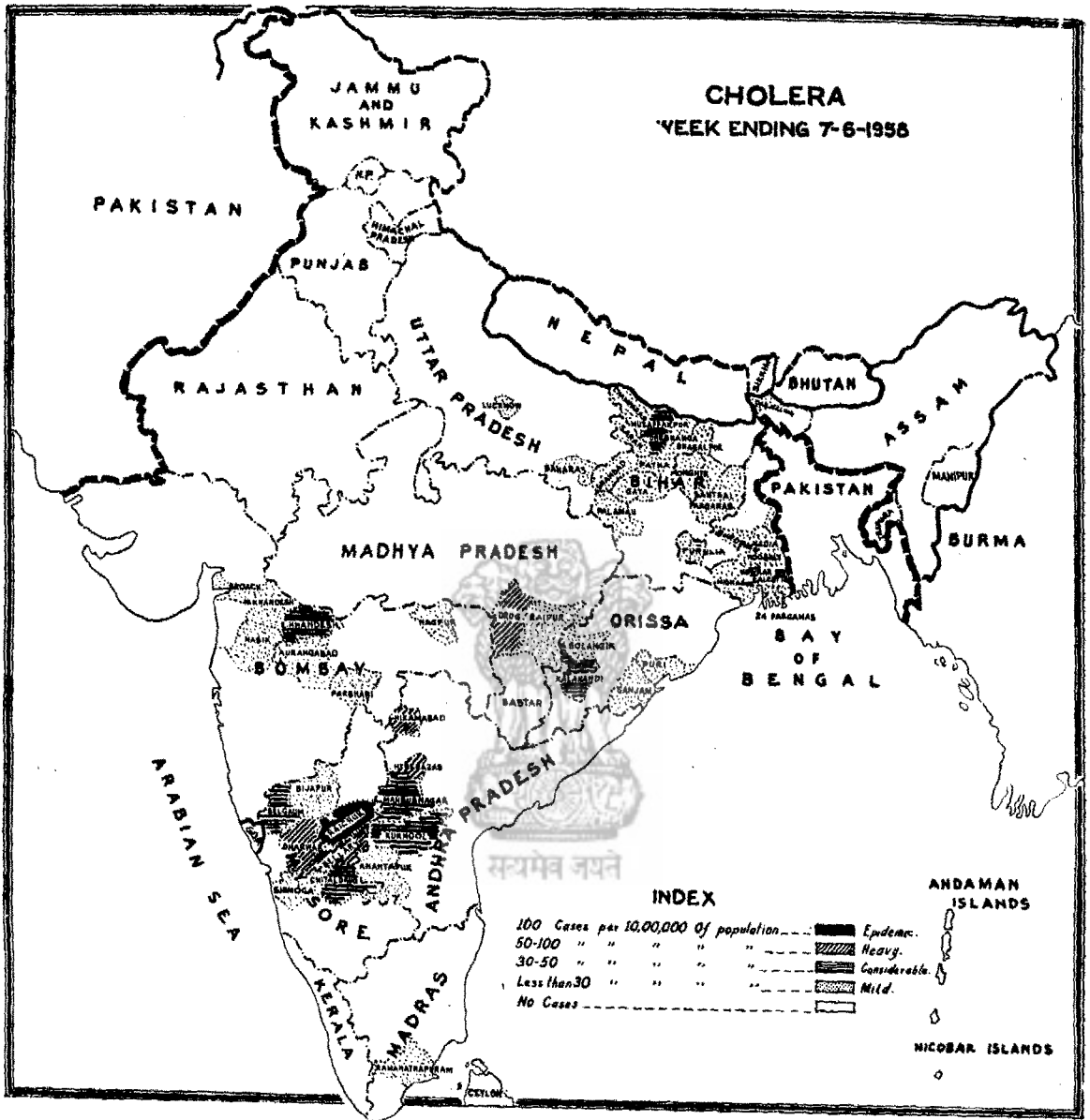
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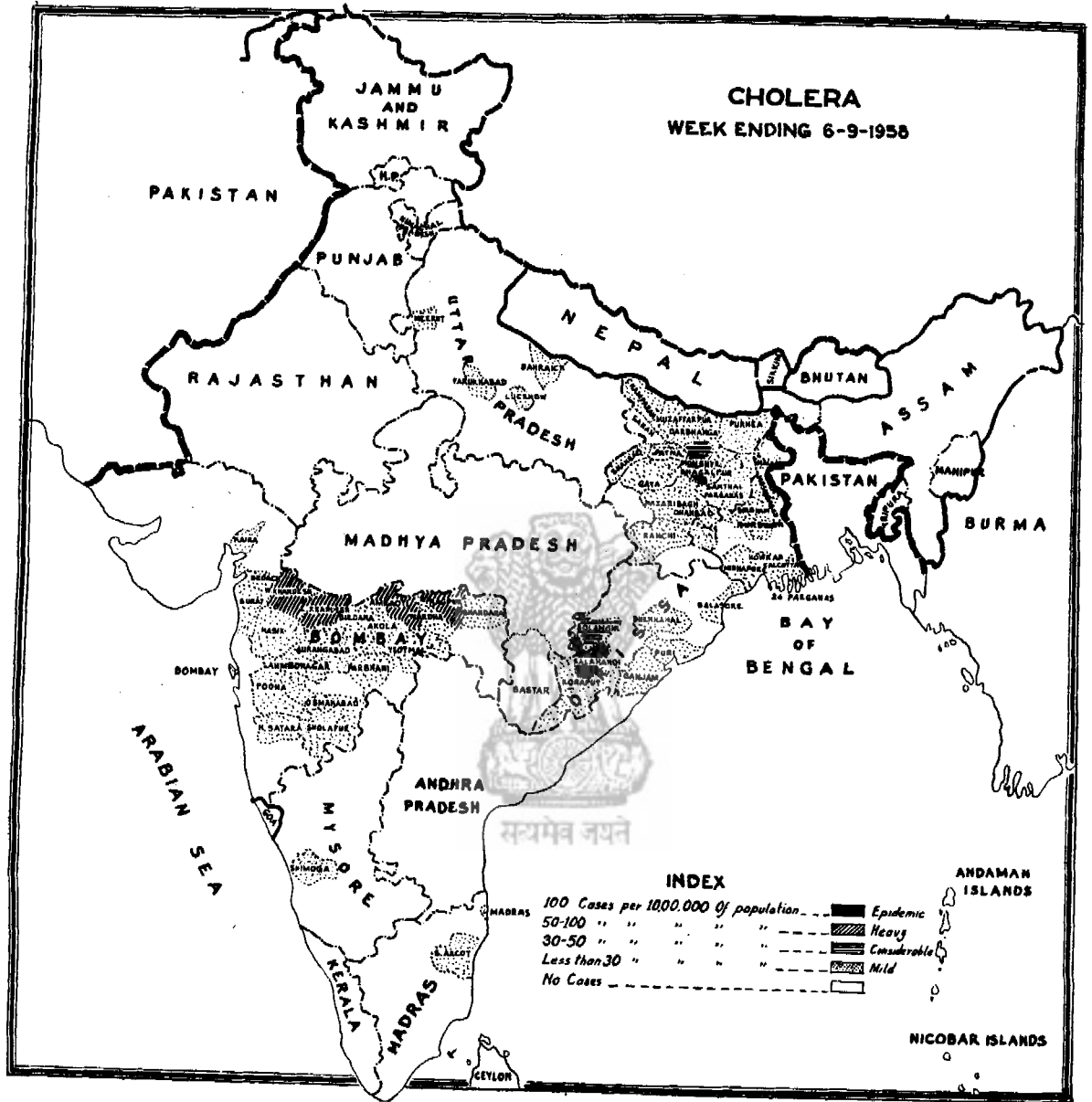


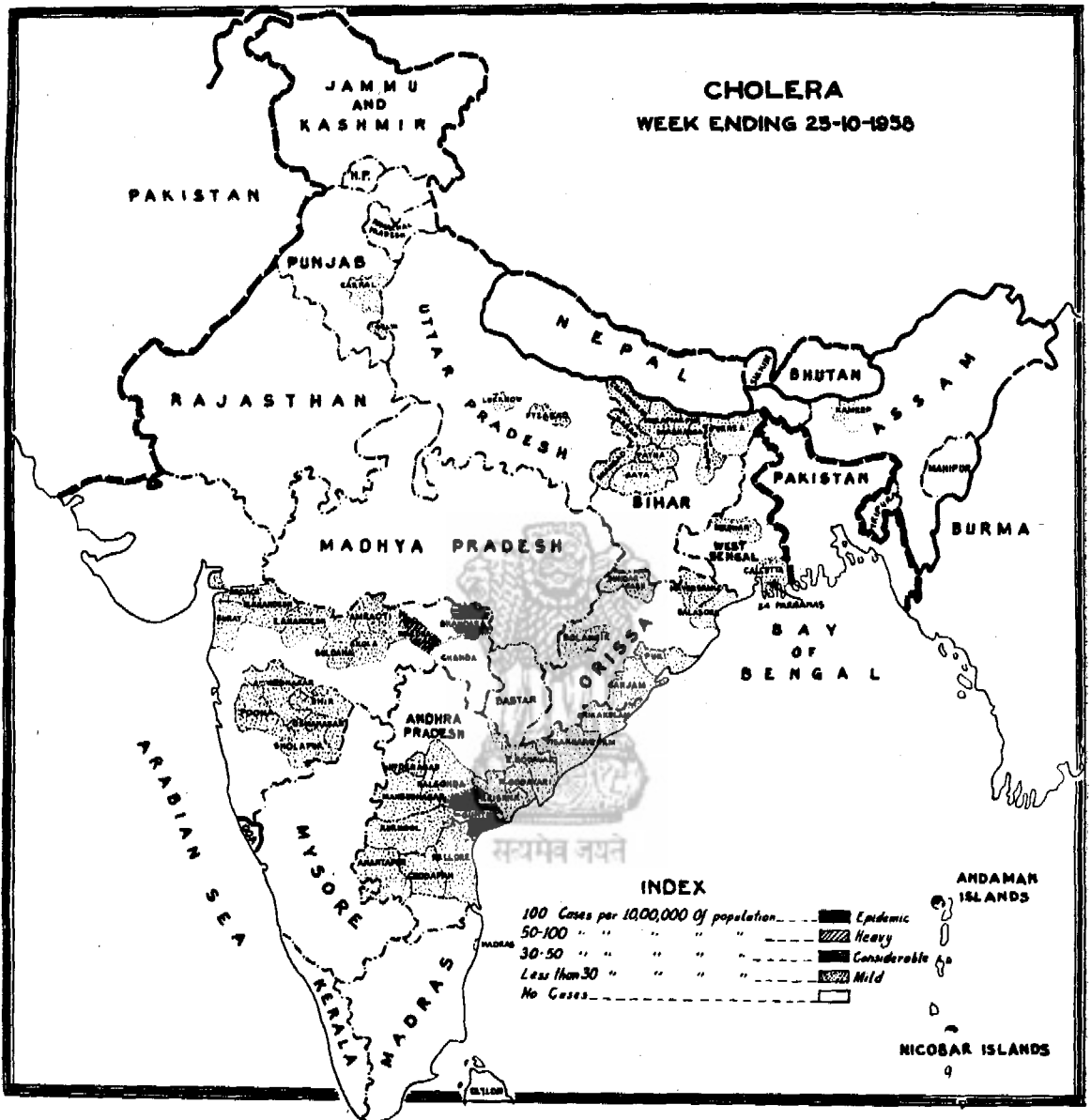


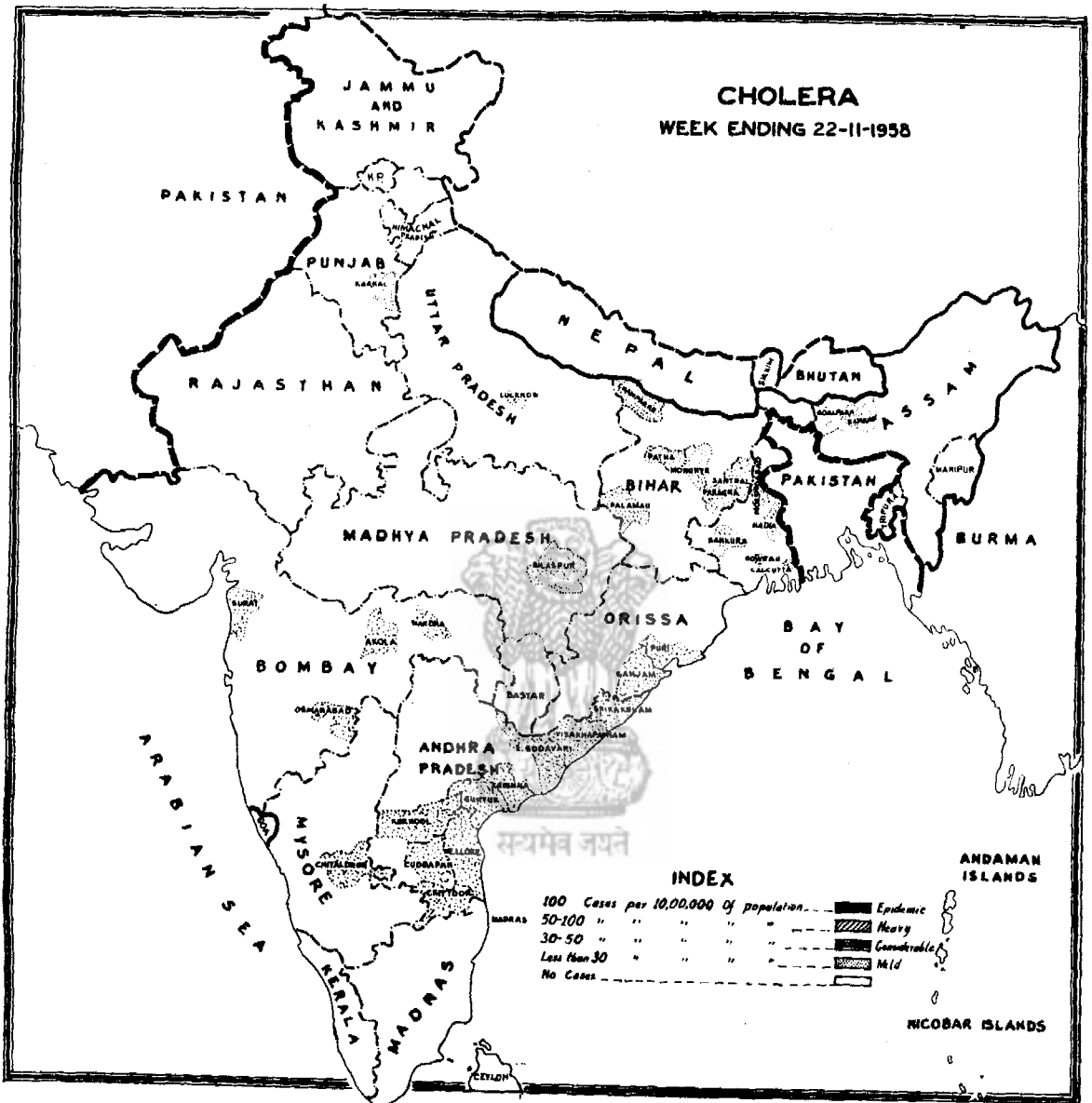


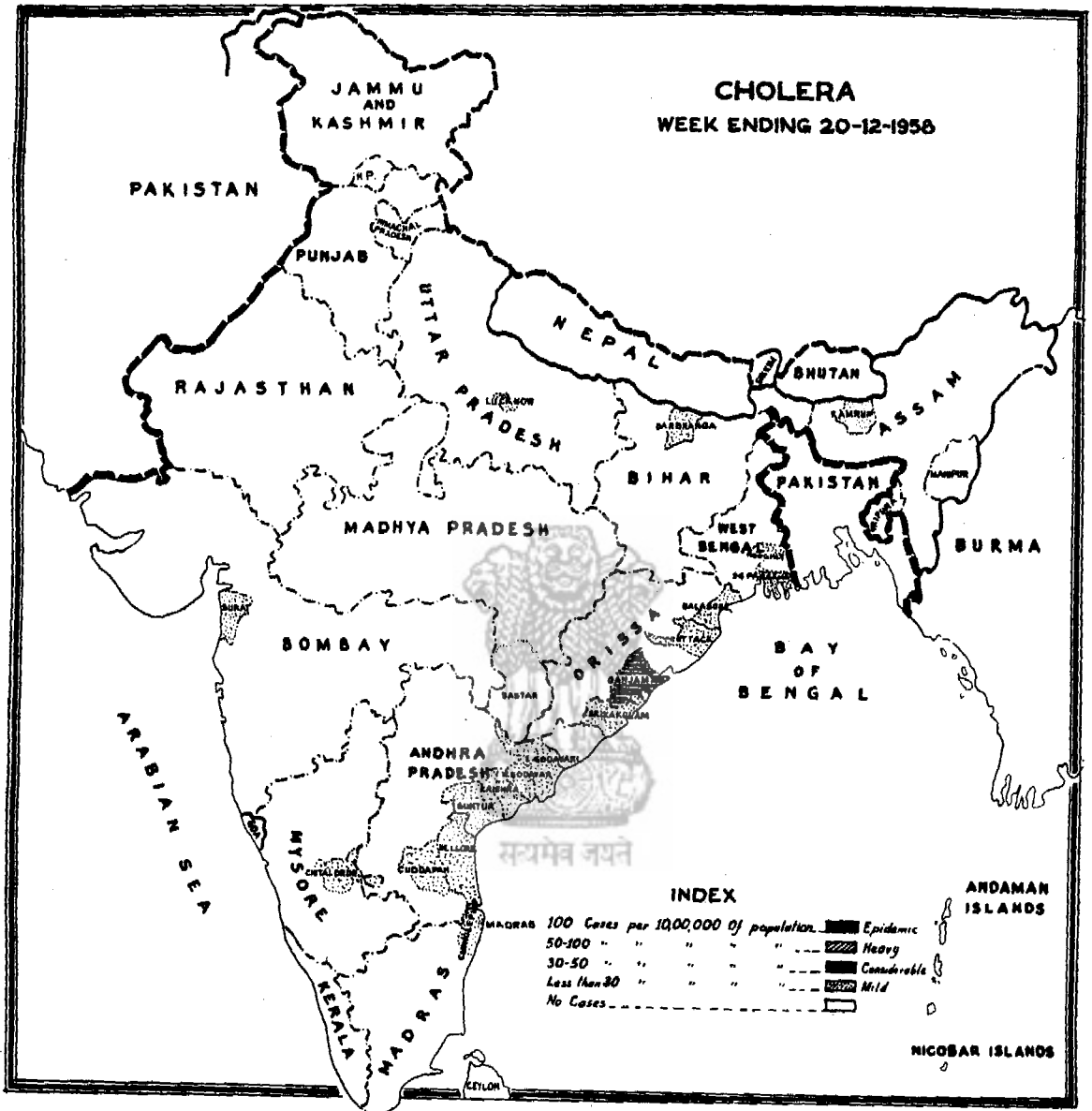




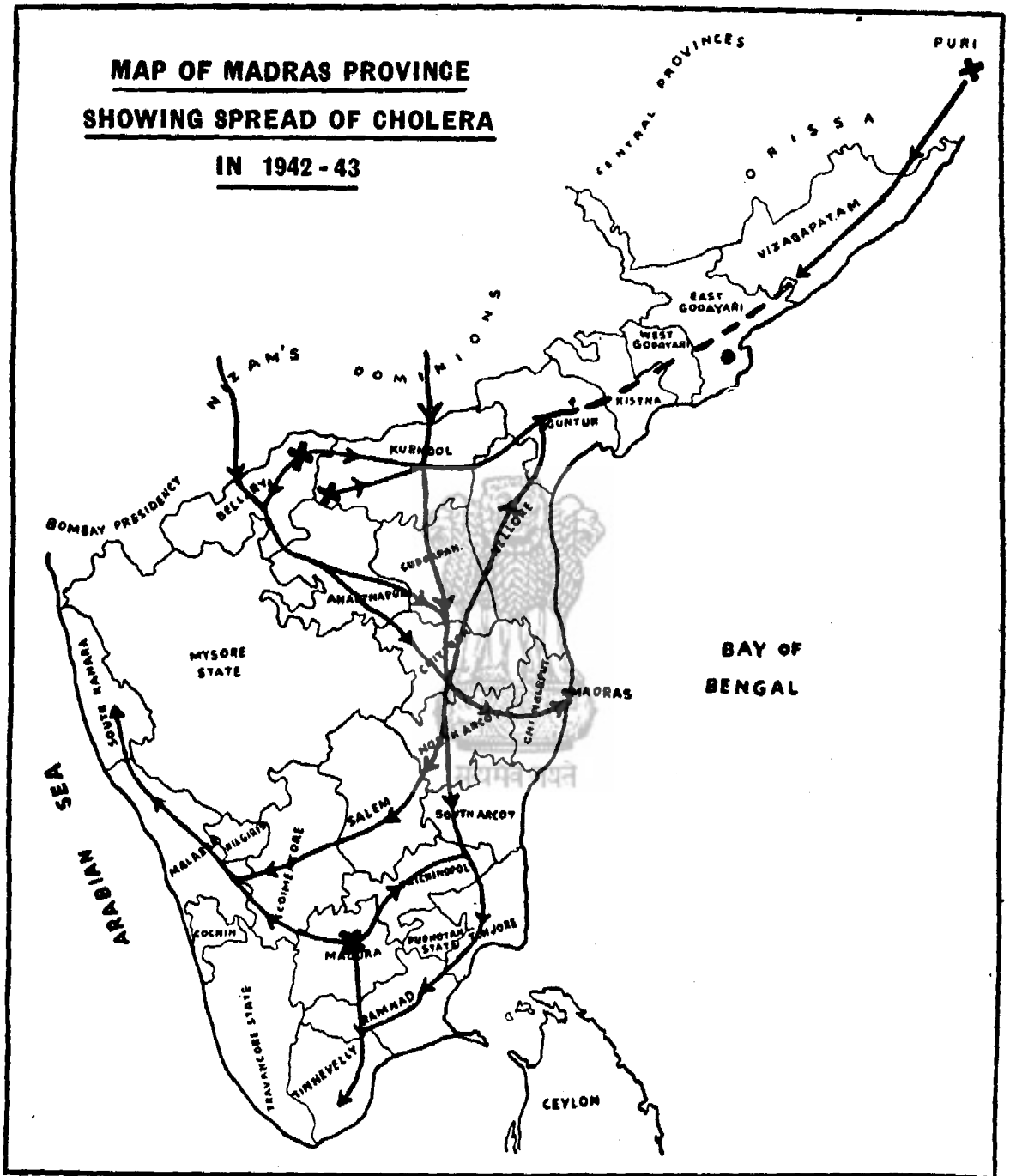












GREATER CALCUTTA  
AREA 390.25 SQ.MILES

LEGEND.

- PLACES COVERED IN THE FIRST FIVE YEAR PLAN \_\_\_\_ ○
- PLACES COVERED IN THE SECOND FIVE YEAR PLAN \_\_\_ ⊙
- PLACES PROPOSED IN THE THIRD FIVE YEAR PLAN \_\_\_ ⊗

